Renewable Energy Transmission Initiative

PHASE 2A

DRAFT REPORT– APPENDICES

June 2009

RETI Coordinating Committee

RETI-1000-2009-001-AP-D

Appendices

Appendix A. Contents of Online Supporting Materials

RETI Phase 2A Draft Report scenario inputs, calculations, and results are publicly available online at the RETI web site, www.energy.ca.gov/reti, in an Excel workbook file named: Conceptual_Plan_Data_09-05-31.

Workbook sheet names and material:

1. **Flow Chart** – assessment flow chart included in Section 2 of the draft Report.
2. **PlanComponents** – complete list of all transmission facilities included in the plan.
3. **SegmentData** – list of line segments included with associated data.
4. **NetShort** – LSE net short data used to compute shift factors.
5. **ShiftFactorMatrix** – shift factors computed by SDG&E.
6. **ABS-SFmatrix** – absolute values of the shift factors.
7. **CutOffSFmatrix** – identifies shift factors greater than 5%.
8. **CREZdata** – complete revised CREZ data used in plan assessment.
9. **CREZ Bubble Chart** – CREZ economic and environmental scores in bubble chart format with CREZ energy determining bubble size.
10. **Crez Bubble Chart Notes**
11. **SegCREZEnergyMatrix** – shift factors multiplied by CREZ energy.
12. **SegEconScoreMatrix** – shift factors multiplied by CREZ energy weighted by adjusted CREZ economic scores.
13. **SegCREZEnviroScoreMatrix** - shift factors multiplied by CREZ energy weighted by adjusted CREZ environmental scores.
14. **SegCommIntEnergyMatrix** – shift factors multiplied by CREZ energy of commercial interest.
15. **SegSummary** – total results for all line segments.
16. **SegCorrelationChart** – line segment results charted to show correlations.
17. **GroupSegNames** – names of line segments included in each group.
18. **GroupSegMatrix** – identifies group associated with each line segment.
19. **GroupAbsSF** – totals of absolute values of line segment shift factors, by group.
20. **GroupCutoffSF** – total number of CREZ for which line segment carries more than 5% of CREZ energy, by group.
21. **GroupEnergy** – line segment total energy score, by group.
22. **GroupCREZEconScore** – line segment total score for energy weighted by adjusted CREZ economic scores, by group.
23. **GroupCREZEnviroScore** – line segment total score for energy weighted by adjusted CREZ environmental scores, by group.
24. **GroupCommInt** – line segment commercial interest energy score, by group.
25. **GroupCombCREZEnergy** – line segment combined energy score, by group.
26. **GroupCost** – total estimated cost of line segments, by group.
27. **GroupSegEnviroScore** – total environmental scores of line segments, by group.
28. **GroupSummary** – totals for all groups, sortable.
29. **GroupSumSort** – group totals, sorted by category.
30. **Group Bubble Chart** – group cost and environmental scores in bubble chart format with group energy determining bubble size.
31. **Group Bubble Chart Notes**
32. **Group Bar Chart** – normalized group energy, environmental score and cost in bar chart format.

Appendix B. CREZ Energy, Capacity, and Economic, Environmental and Commercial Interest Scores

Tables in Appendix B present CREZ capacity, energy, economic and environmental scores and commercial interest scores, updated to reflect the CREZ revisions described in Chapter 2.

Table B-1 presents estimates of developable capacity, by CREZ, for each renewable generating technology, in MW.

Table B-2 presents estimates of the total energy output of each CREZ, in GWh, for each renewable generating technology; and the pro rata contribution of that CREZ to the statewide renewable net short in 2020. In the column headed, **Net Short Total**, the energy output of each CREZ has been reduced by the ratio of its total output to total statewide net short, so that the aggregate output of all CREZ adds up to the statewide net short.

Table B-3 shows CREZ economic ranking scores and adjusted economic ranking scores; and CREZ environmental ranking scores and adjusted ranking scores. Economic and environmental scores were adjusted for use in the criteria formulas employed to evaluate transmission line segments in this analysis. The criteria formulas and the adjustment process is described in Section 3.3.3.2 and Section 3.3.3.3 of the Phase 2A Draft Report.

Table B-4 presents CREZ commercial interest scores. The column headed, **GWhPPA** shows the amount of CREZ energy contracted for under Power Purchase Agreements; the column headed, **GWhQUE** shows the amount of CREZ energy represented in CAISO or POU interconnection queues. The final column is the sum of the two other columns, also in GWh.

	Phase 2A Capacity (MW) updated 3/27				
CREZ Name	Biomass	Geoth.	Solar Th.	Wind	Total
Baja	0	0	0	2,368	2,368
Barstow	0	0	1,400	936	2,336
British Columbia	0	90	0	250	340
Carrizo North	0	0	1,600	0	1,600
Carrizo South	0	0	3,000	0	3,000
Cuyama	0	0	400	0	400
Fairmont	138	0	2,000	1,380	3,518
Imperial East	0	0	1,600	123	1,723
Imperial North-A	0	1,370	0	0	1,370
Imperial North-B	30	0	1,800	0	1,830
Imperial South	36	64	3,150	45	3,295
Inyokern	0	0	2,145	287	2,432
Iron Mountain	0	0	5,600	62	5,662
Kramer	0	24	6,185	203	6,412
Lassen North	0	0	0	1,467	1,467
Lassen South	0	0	0	410	410
Mountain Pass	0	0	780	878	1,658
Needles	0	0	800	261	1,061
Nevada N	0	115	0	0	115
Nevada C	0	352	0	0	352
Oregon	0	392	0	0	392
Owens Valley	0	0	1,400	0	1,400
Palm Springs	0	0	0	770	770
Pisgah	0	0	1,800	0	1,800
Riverside East	0	0	7,800	0	7,800
Round Mountain-A	0	384	0	0	384
Round Mountain-B	55	0	0	132	187
San Bernardino - Baker	0	0	3,670	0	3,670
San Bernardino - Lucerne	91	0	2,340	599	3,030
San Diego North Central	0	0	0	281	281
San Diego South	0	0	0	678	678
Santa Barbara	0	0	0	433	433
Solano	0	0	0	894	894
Tehachapi	37	0	7,195	3,605	10,837
Twentynine Palms	0	0	1,805	0	1,805
Victorville	0	0	1,200	436	1,636
Totals	**387**	**2,791**	**57,670**	**16,499**	**77,347**

Table B-1: Phase 2A CREZ Developable Capacity

	Phase 2A Energy (GWh) updated 3/27					
CREZ Name	Biomass	Geoth.	Solar Th.	Wind	Total	Net Short Total
Baja	0	0	0	8,035	8,035	2,243
Barstow	0	0	3,369	2,487	5,856	1,635
British Columbia	0	710	0	1,139	1,849	516
Carrizo North	0	0	3,395	0	3,395	948
Carrizo South	0	0	6,440	0	6,440	1,798
Cuyama	0	0	892	0	892	249
Fairmont	967	0	5,251	4,136	10,355	2,891
Imperial East	0	0	3,864	337	4,201	1,173
Imperial North-A	0	10,626	0	0	10,626	2,966
Imperial North-B	210	0	4,297	0	4,507	1,258
Imperial South	250	449	7,367	119	8,185	2,285
Inyokern	0	0	5,609	713	6,322	1,765
Iron Mountain	0	0	13,232	151	13,383	3,736
Kramer	0	168	15,914	471	16,553	4,621
Lassen North	0	0	0	3,784	3,784	1,056
Lassen South	0	0	0	1,106	1,106	309
Mountain Pass	0	0	1,900	2,436	4,336	1,210
Needles	0	0	1,950	699	2,649	740
Nevada N	0	822	0	0	822	229
Nevada C	0	2,624	0	0	2,624	733
Oregon	0	3,062	0	0	3,062	855
Owens Valley	0	0	3,613	0	3,613	1,009
Palm Springs	0	0	0	2,595	2,595	724
Pisgah	0	0	4,509	0	4,509	1,259
Riverside East	0	0	18,833	0	18,833	5,258
Round Mountain-A	0	2,691	0	0	2,691	751
Round Mountain-B	385	0	0	357	742	207
San Bernardino - Baker	0	0	8,707	0	8,707	2,431
San Bernardino - Lucerne	638	0	5,837	1,669	8,143	2,273
San Diego North Central	0	0	0	739	739	206
San Diego South	0	0	0	1,926	1,926	538
Santa Barbara	0	0	0	1,180	1,180	329
Solano	0	0	0	2,865	2,865	800
Tehachapi	259	0	18,433	10,781	29,473	8,228
Twentynine Palms	0	0	4,616	0	4,616	1,289
Victorville	0	0	3,048	1,222	4,271	1,192
Totals	**2,710**	**21,152**	**141,075**	**48,948**	**213,885**	**59,710**

Note - Net Short Total equals pro rata CREZ energy needed to meet total net short.

Table B-2: Phase 2A CREZ Energy, by Technology

	Updated 4/1		Updated 4/15/09	
CREZ Name	Phase 2 EconScore	Phase 2Adj EconScore	Phase 2 EnviroScore	Phase 2Adj EnviroScore
Baja	-30.11	47.57	7.19	15.06
Barstow	-2.10	19.56	8.72	13.53
British Columbia	-30.00	47.46	7.19	15.06
Carrizo North	0.95	16.51	8.37	13.87
Carrizo South	3.72	13.74	6.24	16.00
Cuyama	-1.77	19.23	7.19	15.06
Fairmont	-22.55	40.01	10.42	11.82
Imperial East	-0.09	17.55	5.74	16.50
Imperial North-A	-21.62	39.08	2.70	19.54
Imperial North-B	0.44	17.02	9.30	12.95
Imperial South	1.84	15.62	6.81	15.44
Inyokern	-14.95	32.41	7.57	14.68
Iron Mountain	-1.48	18.94	5.24	17.00
Kramer	-15.55	33.01	5.79	16.46
Lassen North	9.41	8.05	7.79	14.45
Lassen South	1.81	15.65	19.43	2.81
Mountain Pass	-2.50	19.96	3.50	18.74
Needles	4.26	13.20	10.00	12.24
Nevada N	-31.20	48.66	7.19	15.06
Nevada C	-39.20	56.66	7.19	15.06
Oregon	-41.38	58.84	7.19	15.06
Owens Valley	-19.38	36.84	5.21	17.03
Palm Springs	-35.94	53.40	8.04	14.20
Pisgah	-5.81	23.27	4.02	18.23
Riverside East	-5.49	22.95	5.06	17.19
Round Mountain-A	-30.31	47.77	3.37	18.87
Round Mountain-B	17.46	0.00	8.44	13.80
San Bernardino - Baker	1.23	16.23	6.74	15.50
San Bernardino - Lucerne	-2.25	19.71	7.67	14.57
San Diego North Central	-0.32	17.78	22.24	0.00
San Diego South	-12.29	29.75	5.50	16.74
Santa Barbara	1.07	16.39	9.16	13.08
Solano	-38.93	56.39	7.61	14.63
Tehachapi	-20.09	37.55	4.57	17.67
Twentynine Palms	-9.83	27.29	4.76	17.49
Victorville	-8.92	26.38	8.21	14.03
Median CA			**7.19**	

Notes -

Out of state CREZ have been assigned the median CA CREZ environmental score.

Adjusted scores are used in scenario assessments.

Unadjusted scores are used in the CREZ bubble chart.

Table B-3: CREZ Economic and Environmental Ranking Scores

	Updated 4/30/09		
CREZ Name	GWHPPA	GWHQUE	SUM GWHPQ
Baja	0	10,246	10,246
Barstow	0	586	586
British Columbia	0	0	0
Carrizo North	227	1,272	1,499
Carrizo South	1,245	2,224	3,469
Cuyama	0	234	234
Fairmont	0	1,155	1,155
Imperial East	0	2,173	2,173
Imperial North-A	0	3,469	3,469
Imperial North-B	0	0	0
Imperial South	2,105	5,439	7,543
Inyokern	0	118	118
Iron Mountain	0	6,498	6,498
Kramer	0	8,491	8,491
Lassen North	4,555	5,194	9,749
Lassen South	0	1,612	1,612
Mountain Pass	731	1,636	2,367
Needles	0	802	802
Nevada N	0	1,501	1,501
Nevada C	0	1,580	1,580
Oregon	0	0	0
Owens Valley	0	0	0
Palm Springs	339	2,146	2,485
Pisgah	5,135	14,233	19,368
Riverside East	0	10,019	10,019
Round Mountain-A	2,000	0	2,000
Round Mountain-B	0	0	0
San Bernardino - Baker	0	3,948	3,948
San Bernardino - Lucerne	0	998	998
San Diego North Central	0	298	298
San Diego South	0	2,007	2,007
Santa Barbara	327	327	654
Solano	1,000	4,743	5,743
Tehachapi	8,494	28,836	37,330
Twentynine Palms	0	5,115	5,115
Victorville	0	2,445	2,445

Table B-4: CREZ Commercial Interest Scores

Appendix C. CREZ Environmental Issues Matrices

Environmental considerations and other issues that could potentially affect the ability to site and permit renewable energy generating projects were evaluated for each of the 29 California CREZ using environmental issues matrices. These can be found in online supporting materials, at http://www.energy.ca.gov/reti.

Appendix D. Transmission Line Environmental Issues Checklist

Matrices listing the 108 line segments evaluated by the environmental expert panel can be found in online supporting materials at http://www.energy.ca.gov/reti.

Appendix E. Environmental Expert Panel Participants

Two groups or panels of experts – one each for northern and southern California – were assembled by the co-chairs of the EWG, with the advice of RETI coordinators and other RETI participants. Participants were selected for their knowledge of the natural and cultural resources potentially affected by potential line segments and/or the impacts of construction, maintenance and operation of transmission lines.

Members of the Northern California panel were: Billie Blanchard, CPUC; Peter Cross, US Fish and Wildlife Service (USFWS); Robert Dowds, Westlands Water District; Scott Flint, California Department of Fish and Game (DFG); Bob Hawkins, consultant to the US Forest Service (USFS); Roger Johnson, CEC; Julie Tupper, USFS; Johanna Wald, NRDC; and Carl Zichella, Sierra Club. Participating experts for Southern California segments were Ileene Anderson, Center for Biological Diversity (CBD); Billie Blanchard, CPUC; Ray Bransfield, Jody Frazier, and Tannika Engelhard, USFWS; Ashley Conrad-Saydah, BLM; Scott Flint, DFG; Roger Johnson, CEC; Russell Scofield, US Department of the Interior (DOI); Julie Tupper, USFS: Johanna Wald, NRDC; and Carl Zichella, Sierra Club.

Each of these panels met separately to review the segments within their respective regions. The meetings were conducted via WebEx to enable all experts to participate and to allow interested members of the SSC, the EWG and the public to observe. Only panel members participated in scoring discussions and decisions.

Scoring involved use of the checklist, which can be found in the online supporting materials for Appendix C, that identified potential environmental and other issues of concern as well as other information relevant to the scoring process, in particular the rating formula developed by the CRWG and accepted by the other members of the Phase 2 Working Group. The checklists shown in the online supporting materials for Appendix C were filled out for each conceptual transmission segment. The completed checklists provide a documentary record of the considerations taken into account by the experts in arriving at each judgment score.

Appendix F. Line Segments in Each Group

Line segment identifiers include the names of the two substations they connect. Segments comprising each Group are listed below, by their abbreviated identifier. In Appendix H, these are referred to as Segment Short Names. Appendix H lists the full names and descriptions of the segments below, in alphabetical order. To take an example, the segment, DILL_TRACY2_1 below is shown in Appendix H to refer to the first 500 kV line circuit between the Dillard Road substation and the Tracy 2 substation.

Foundation	Delivery	Tehachapi	LEAPS	North
DILL_TRCY2_1	ALPH4_ALPH1_1	CHNO_MESA_1	CMPL_ECND_1	COLL_TRCY2_1
DVR2_VICT_1	ALPH4_ALPH1_2	CHNO_MIRA_1	CMPL_ECND_2	NEO_COLL_1
GREG_ALPH4_1	ALPH4_PARK_1	CHNO_MIRA_2	CMPL_TALG_1	SELK_NEO_1
GREG_ALPH4_2	ALPH4_PARK_2	CHNO_MIRA_3	CMPL_TALG_2	SELK_NEO_2
KRAM_LUGO_1	COLL_PITT_1	DRTE_MIRA_1	LELK_CMPL_1	
KRAM_WHUB_1	COLL_PITT_2	DRTE_RIOH_1		
LUGO_VICT_2	DEVR_VALL_2	GOOD_MESA_1		
MIDW_GREG_1	DEVR_VALL_3	GULD_GOOD_1		
MIDW_GREG_2	DVR2_CENT_1	RIOH_MESA_1		
MIDW_KRAM_1	LIVR_DELT_1	VINC_DRTE_1		
MIDW_KRAM_2	TESL_NEWK_1	VINC_GULD_1		
MIDW_WRLW_1	TRCY2_LIVR_1	WHUB_WRLW_1		
TRCY2_ALPH4_1	TRCY2_TRCY_1	ANTE_VINC_1		
TRCY2_ALPH4_2		WRLW_ANTE_1		

NorthEast	Carrizo	BarrenRidge	Inyo	MtPass
OLND_DILL_1	GATE_MBAY_1	BRNR_HASC_1	CONT_LPIN_1	BAKR1_BARS1_1
ZETA1_OLND_1	MIDW_CARZ_1	BRNR_HASC_2	INYK_KRAM_1	BARS1_LUGO_1
ZETA1_RDMT_1		CAST_HASC_2	LPIN_INYK_1	MTPS1_BAKR1_1
		HASC_RNLD_1		MTPS1_ELDO_1

Pisgah	IronMt	Riverside	Imperial	Imperial, cont'd
LUCV_LUGO_1	IRMT_SCEJ_1	DESC_DEVR_1	AV58_CHCV_1	DIXL_BANN_1
PISG_LUCV_1	IRMT_SCEJ_2	DESC_DEVR_2	BANN_AV58_1	ELCN_HILN_1
PISG_MIRA_1	SCEJ_CAMI_1	JULH_DESC_1	BANN_CHCV_1	ELCN_HILN_2
	SCEJ_PISG_1	JULH_DESC_2	BANN_DEVR_1	ELCN_IMPV2_2
	SCEJ_PISG_2	JULH_EGMT_1	BANN_ELCN_1	IMPV_BANN_1
		JULH_EGMT_2	BANN_GEO_1	IMPV_XFMR_2
		MIDP_DESC_1	BANN_GEO_2	IMPV_XFMR_3
		EGM2_DEVR_1	CHCV_DVR2_1	MIDW_GEO_1
		EGM2_DEVR_2	CHCV_DVR2_2	MIDW_GEO_2
		EGM2_EGMT_1	CHCV_MIRG_1	MIRG_DEVR_1
		EGM2_EGMT_2	CHCV_MIRG_2	MIRG_DEVR_2
			DEVR_DVR2_1	

Appendix G. Description of Line Segments

Brief descriptions of the electrical location and purpose of potential line segment connections are included below. Many are conceptual or planned components of transmission projects proposed by Imperial Irrigation District, Los Angeles Department of Water and Power, PG&E, Southern California Edison Company, and Transmission Agency of Northern California, who have provided these descriptions.

I. Southern California Segments

Imperial Irrigation District Upgrades

Imperial Irrigation District (IID) has been at the forefront of promoting renewable energy in the Imperial Valley. Nearly twenty years ago, IID upgraded its transmission system by building a 230 kV collector system to accommodate the interconnection of new geothermal generation and export this renewable energy to Southern California Edison (SCE). Today, IID wheels approximately 550 MW of geothermal energy from Imperial Valley into the California Independent System Operator (CAISO) balancing authority area.

IID has developeda detailed long-term transmission plan (ten years plus timeframe) to define the transmission improvements necessary to continue meeting the load service requirements in future years as well as facilitate the export of renewable resources from the Imperial Valley area. The plan has primarily focused on the upgrade of certain sections of IID's 161 kV transmission system to 230 kV to integrate the existing 230 kV collector system and create a 230 kV transmission loop that will cover most of IID service area to facilitate the export of renewable generation to the north, south and east of IID's service area. The individual project componens of this plan are described below.

1. **El Centro Switching Station (ECSS) to Highline Station double circuit 230 kV transmission line.**

   Upgrade to double circuit 230 kV, the ECSS to Pilot Knob 161 kV and the ECSS to Drop 4 92 kV line sections (18 miles) from ECSS to one mile south of Highline Station, build one mile of double circuit 230 kV line to extend the line from ECSS into Highline station. Build one mile of double circuit 230 kV line to interconnect the remaining 161 kV line to Pilot Knob and the 92 kV line to Drop 4 into Highline station.

2. **Bannister Switching Station and single circuit 230 kV line to the proposed GEO Station**

   Build a 230 kV switching station (Bannister) in the southwest area of the Salton Sea, build 16 miles of single circuit 230 kV transmission line (prepared for double circuit) from Bannister switching station to GEO station

3. **El Centro Switching Station (ECSS) to Dixieland substation single circuit 230 kV transmission line**

   Build 15.5 miles of single circuit 230 kV transmission line from ECSS to Dixieland substation.

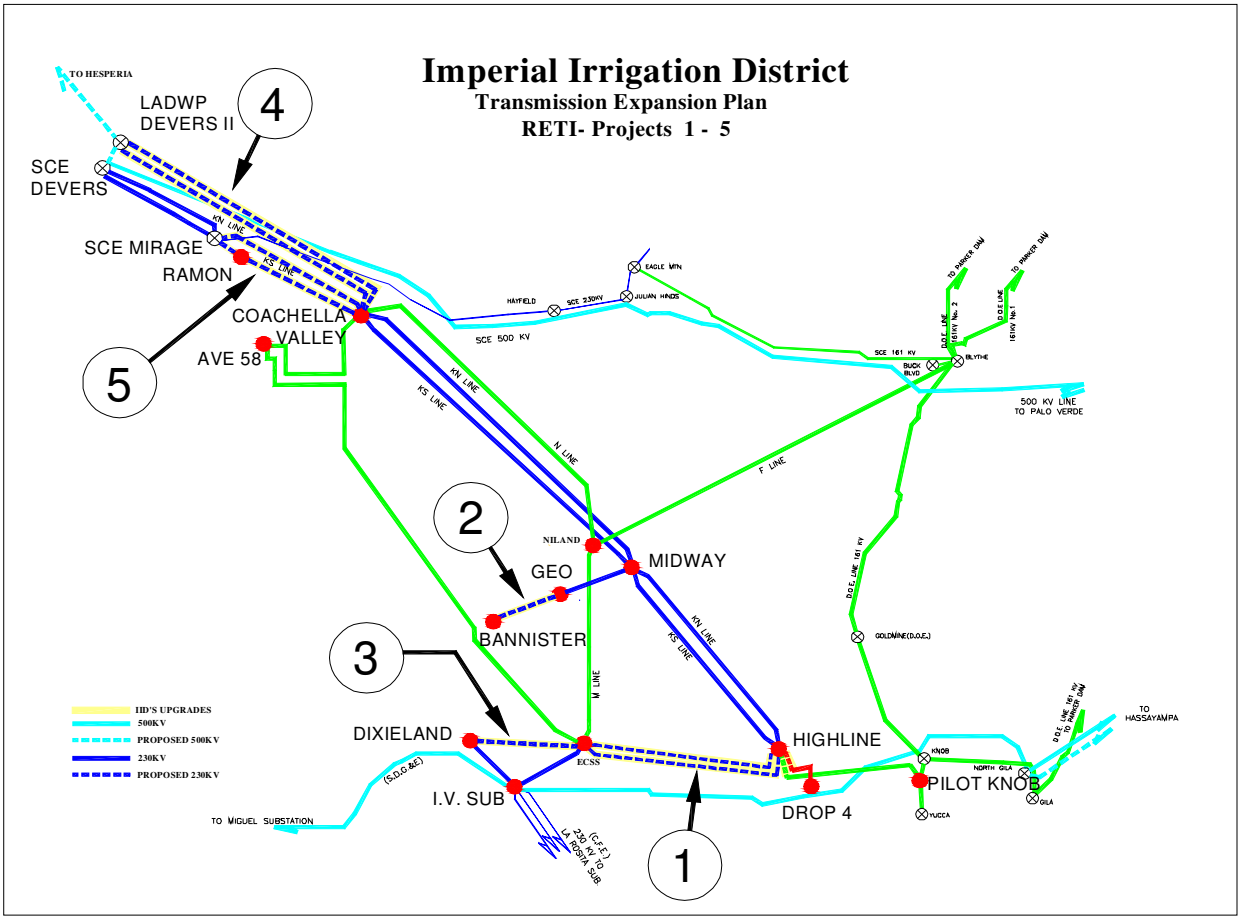
4. **Coachella Valley Substation (ECSS) to proposed Devers II 500/230 kV Substation 230 kV transmission line path**

   Build 35 miles of double circuit 230 kV transmission line between Coachella Valley substation to a proposed Devers II substation.

5. **Coachella Valley Substation to Mirage Substation (Path 42) double circuit 230 kV line upgrade from 800 MW to 1600 MW**

   Upgrade 20 miles of existing double circuit single conductor 230 kV transmission line to Bundle (two conductors per phase) conductors. The project will increase the thermal rating capacity of the Imperial Irrigation District to Southern California Edison (SCE) interconnection from 800 MW to 1600 MW.

The following figure depicts projects 1 through 5



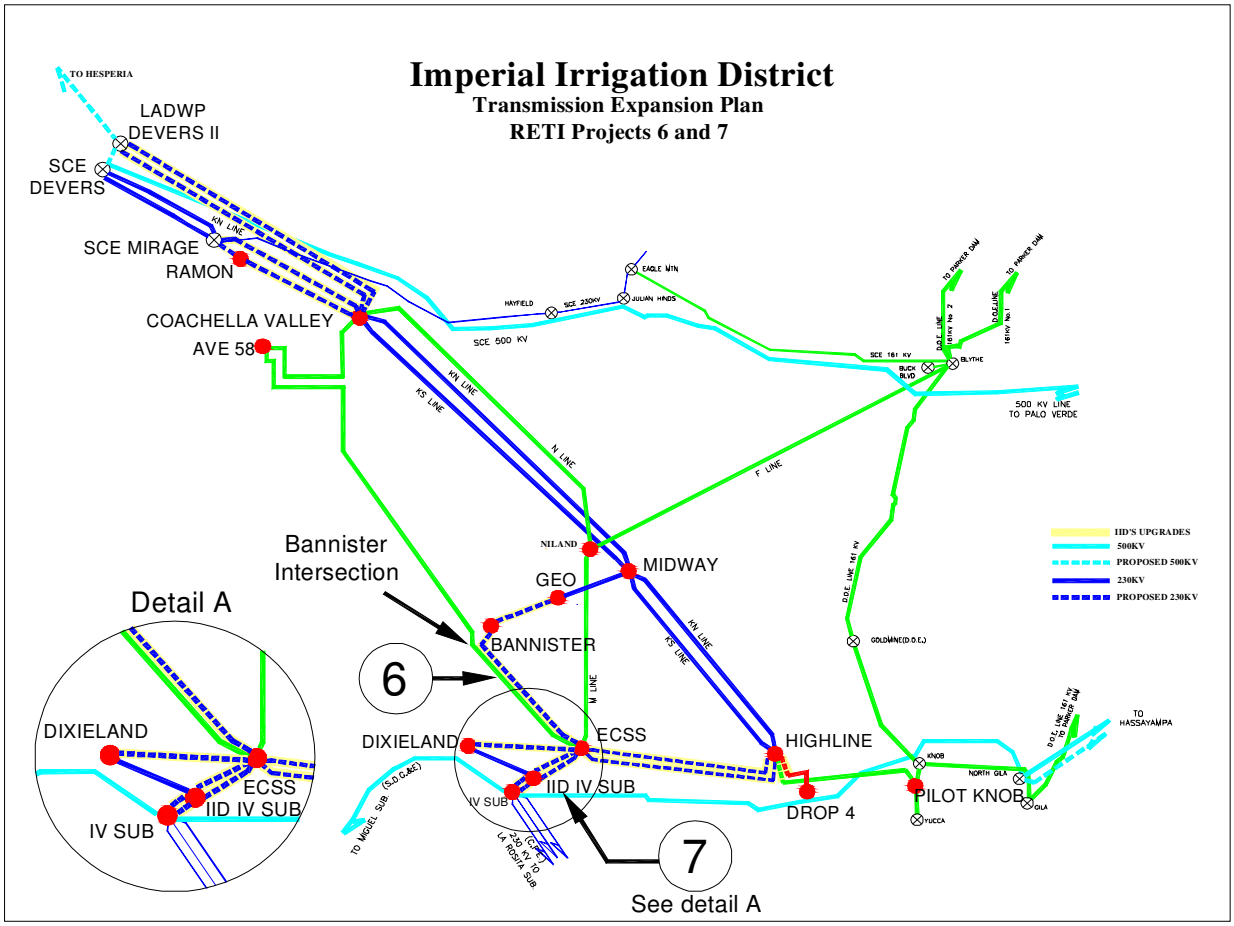
6. **El Centro Switching Station (ECSS) to Bannister switching station double circuit 230 kV transmission line**

   Rebuild 24 miles of the ECSS to AVE 58 substation 161 kV single circuit line to double circuit 230 kV from ECSS to 3.5 miles west of the proposed Bannister substation (Bannister intersection), build 3.5 miles of single circuit 230 kV (prepared to double circuit) line, from Bannister intersection to Bannister substation. One circuit will establish the 230 kV line from ECSS to Bannister and the second circuit from ECSS to Bannister intersection will be operated at 161 kV to interconnect to the remaining 161 kV single circuit line to Ave 58 Substation.

7. **IID IV Sub switching station and to IID IV Sub to ECSS double circuit 230 kV transmission line**

   Build a 230 kV switching station (IID IV SUB) adjacent to SDG&E/IID's Imperial Valley Substation (IV Sub), looping existing IV Sub to Dixieland substation and IV Sub to ECSS 230 kV lines. Establishing the IID IV Sub to Dixieland and IID IV Sub to ECSS 230 kV lines and rebuild the single circuit 230 kV IID IV Sub to ECSS 230 kV line to double circuit 230 KV.

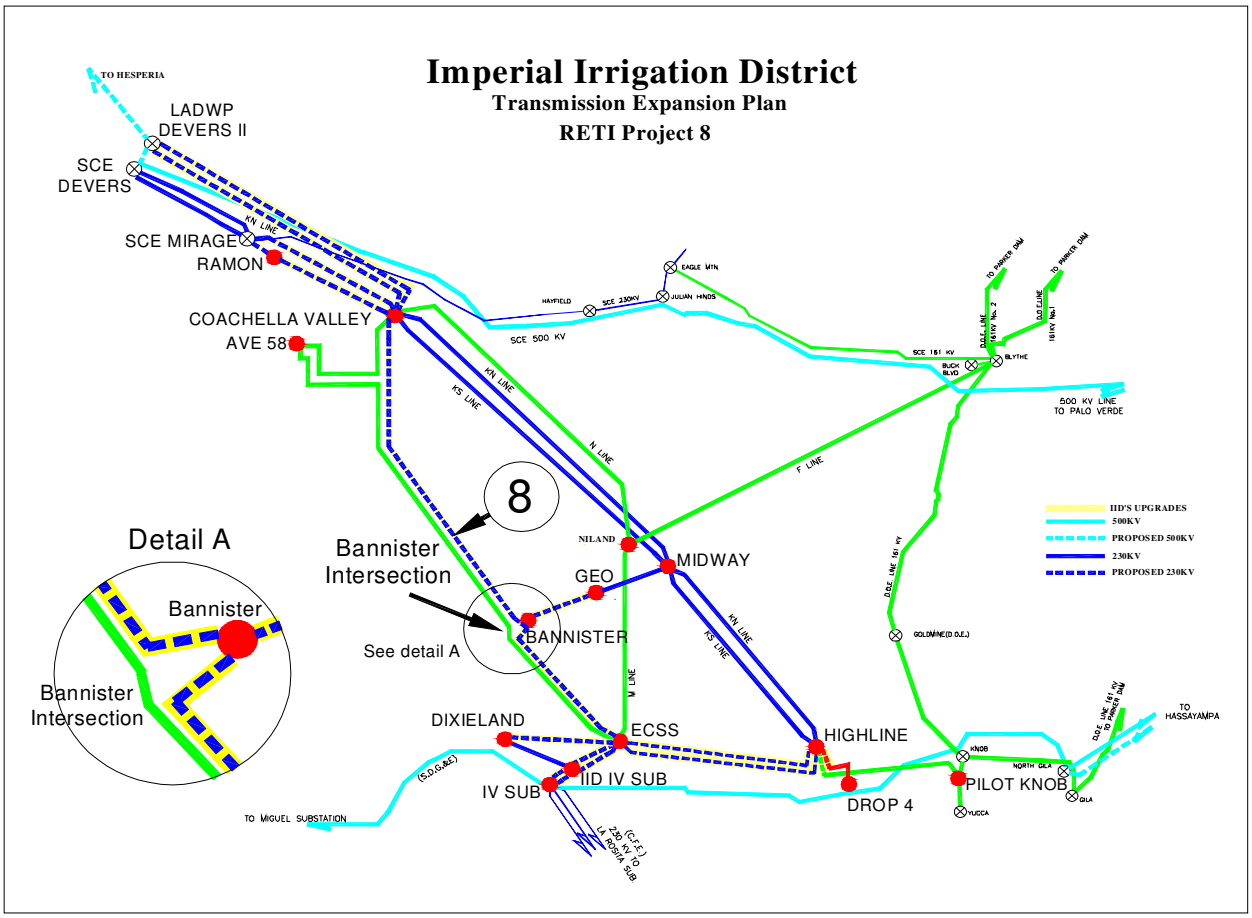
The following figure depicts projects 6 and 7



8. **Bannister SS to Coachella Valley 230 kV transmission line**

Build 3.5 miles of single circuit 230 kV line (prepared to double circuit), from Bannister substation to Bannister intersection; rebuild 46.2 miles of the ECSS to Ave 58 substation single circuit 161 kV line, from Bannister intersection to the intersection with the double circuit 161 kV line into Ave 58 Substation (Ave 58 intersection); upgrade 11.3 miles of double circuit 161 kV line from Ave 58 intersection to Ave 58 Substation; rebuild 6.3 miles of single circuit line to double circuit 230 kV, from Ave 58 intersection to Coachella Valley substation. One circuit will establish the 230 kV line from Bannister substation to Coachella Valley substation and the second circuit will be operated at 161 kV from ECSS to Ave 58 substations and from Ave 58 to Coachella Valley Substations.

The following figure depicts project 8



9. **Midway Station to the proposed GEO Station transmission line; second 230 kV circuit addition**

Add a second sixteen (16) miles 230 kV circuit to the Midway station to GEO station 230 kV transmission line.

10. **GEO station to Bannister Switching Station; second 230 kV circuit addition**

    Add a second sixteen (16) miles 230 kV circuit to the GEO station to Bannister Station 230 transmission line.

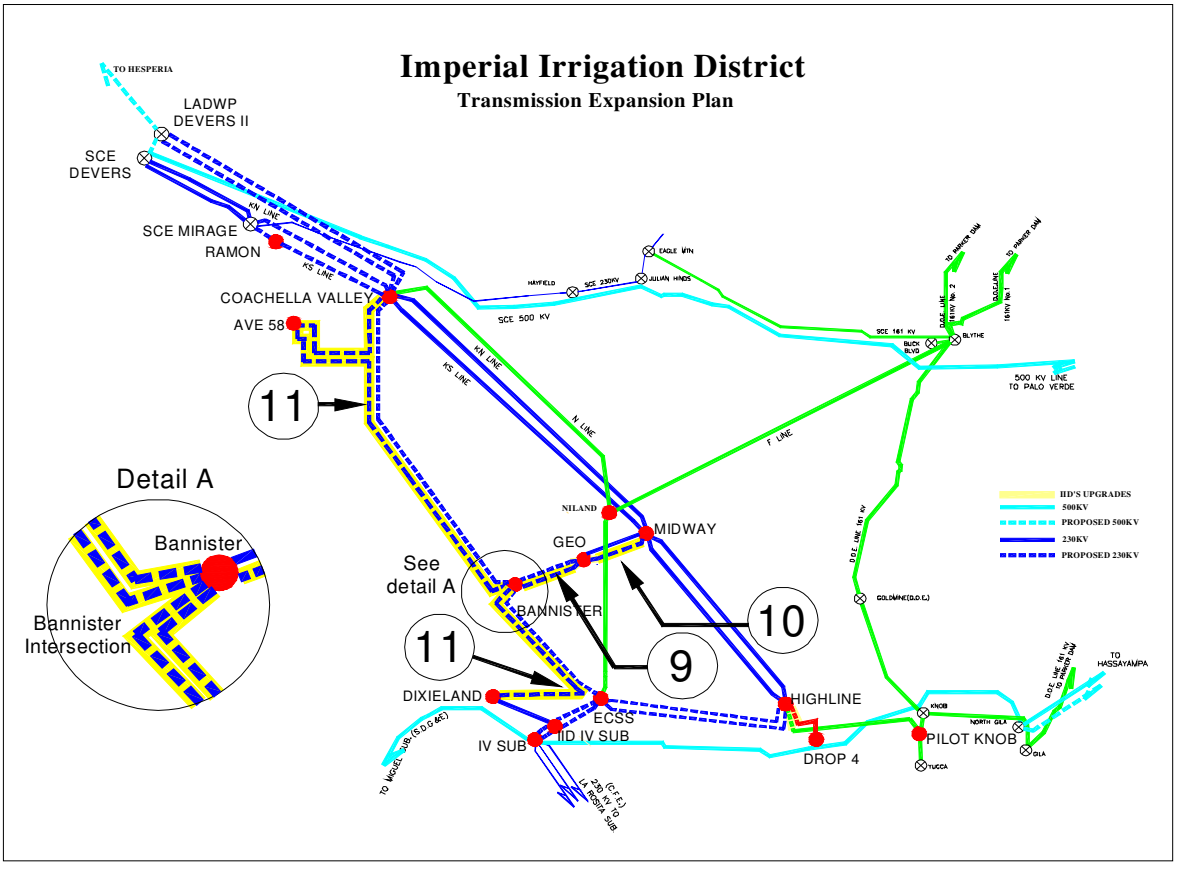
11. **Dixieland Substation - Bannister Switching Station (Bannister SS) - Ave 58 substation - Coachella Valley Substation 230 kV transmission lines.**

    Disconnect the ECSS to Ave 58 and Ave 58 to Coachella Valley substations 161 kV lines (prepared for 230 kV); upgrade the Ave 58 substation 161 kV bus and transformation capacity to 230 kV, re-connect the Ave 58 to Coachella Valley 230 kV transmission line.

    Re-connect the northern end of the ECSS to Ave 58 substation transmission line to Ave 58 230 kV bus, the southern end of the line will be re-routed to Dixieland substation using the Dixieland to ECSS 230 kV transmission line that will be disconnected from ECSS to temporary establish the Dixieland to Ave 58 230 kV line

    Add a second circuit to the 3.5-mile section (Bannister intersection to Bannister SS) of the ECSS to Bannister SS and Bannister SS to Coachella Valley 230 kV lines, loop the Dixieland to Ave 58 230 kV line into Bannister SS using the two new 3.5-mile circuits to establish the Dixieland to Bannister SS and Bannister SS to Ave 58 substation 230 kV transmission line.

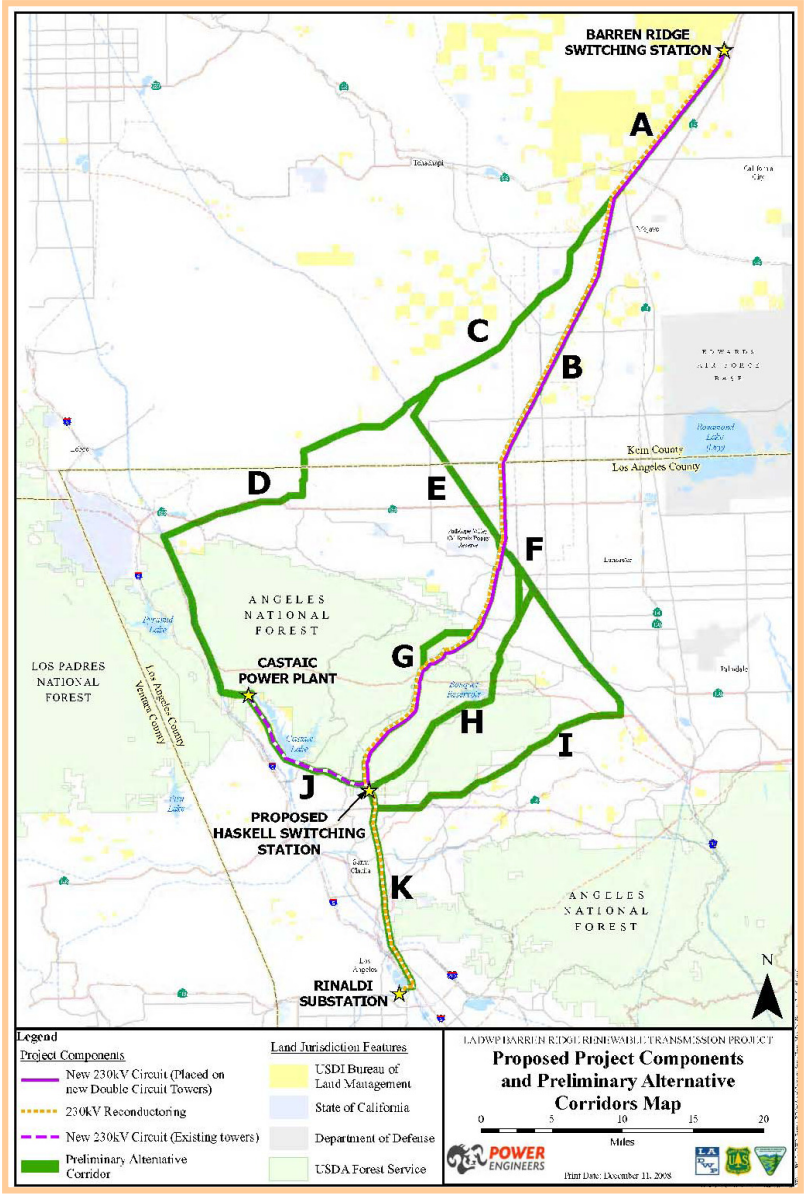
The following figure depicts projects 9 through 11



Los Angeles Department of Water and Power

Barren Ridge Renewable Transmission Project (BRRTP)

The BRRTP is a renewable resources project and consists of a construction of 61-mile double-circuit 230 kV transmission line between the Barren Ride Switching Station and a new Haskell Canyon Switching Station. The Barren Ridge Switching Station is a newly constructed station along the existing Inyo to Rinaldi line approximately 20 miles north of the City of Mojave. The project also consists of the reconductring of the existing line from Barren Ridge to Haskell Canyon. With the construction of the new line and the reconductering, the rating of the existing system, which is approximately 400 MW, will be increases to approximately 2200 MW. The project is presently in the environmental process and is expected to be in service by late 2013. The project map below shows the alternative routes now under environmental study.

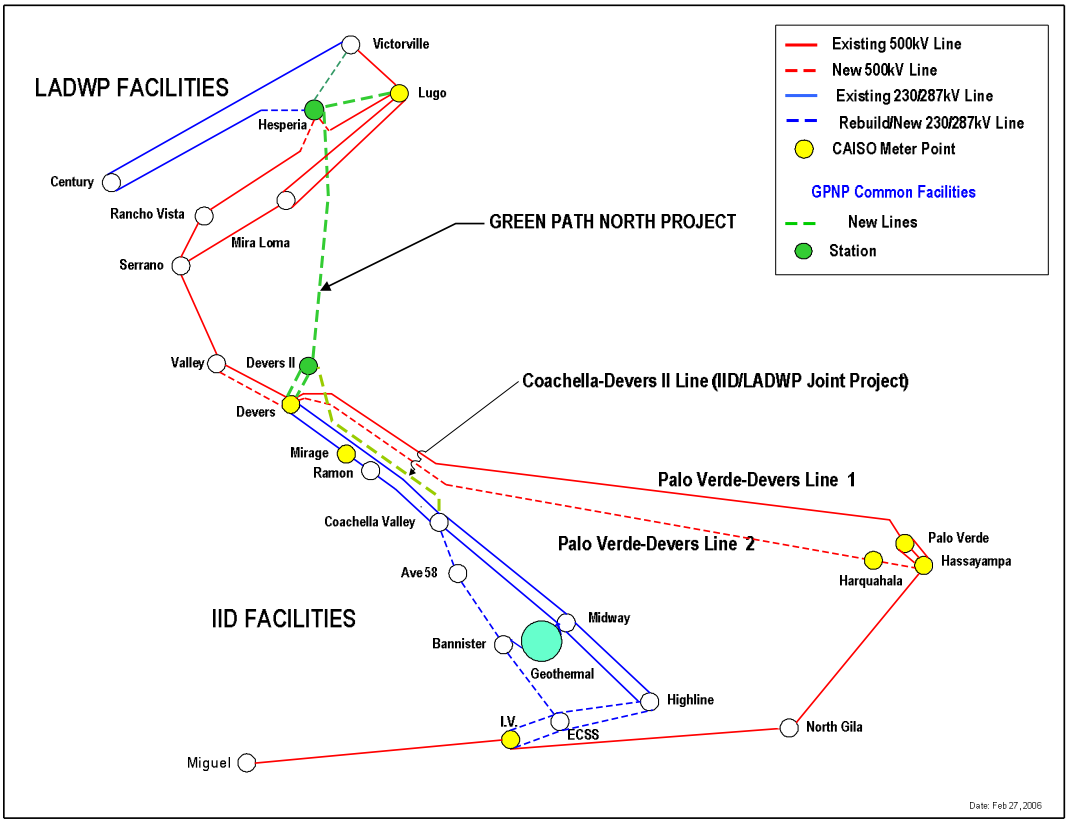


Green Path North Project (GPNP)

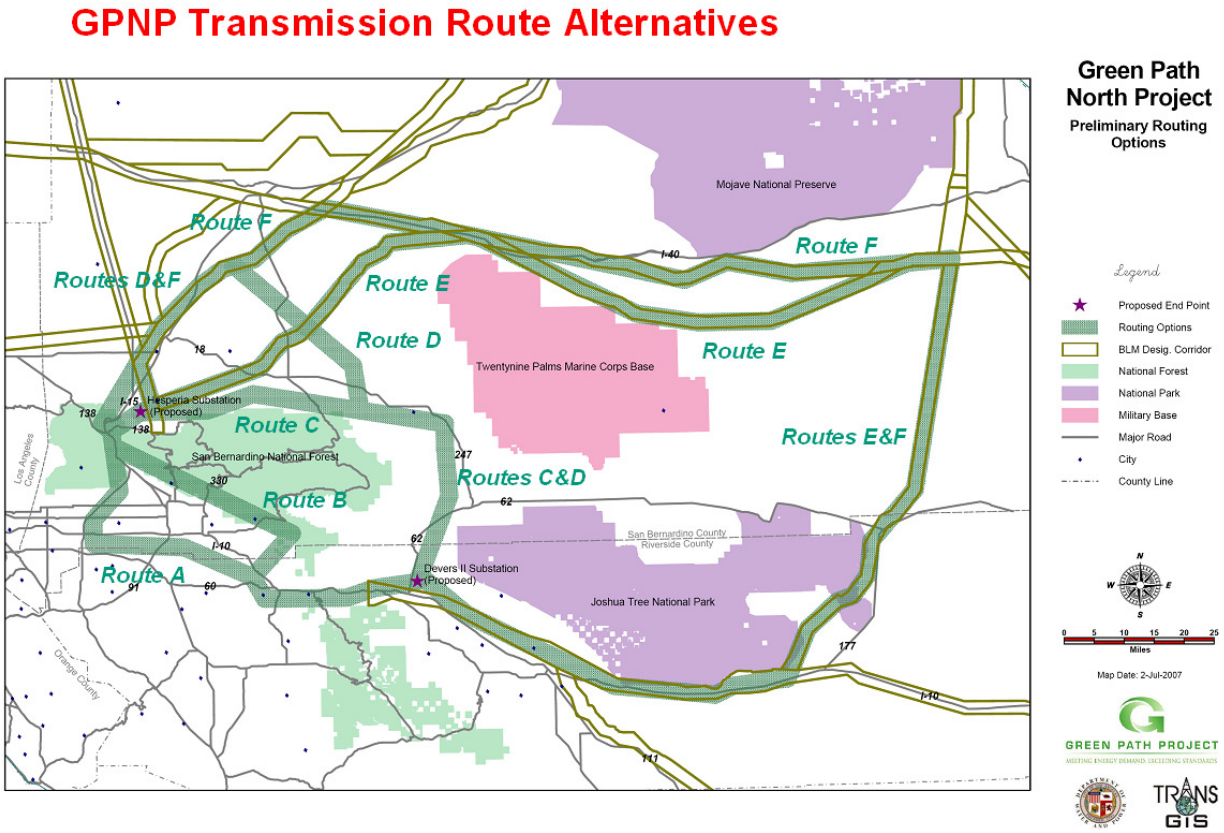
The GPNP is a renewable resource project with the purpose of transmitting a substantial level of Salton Sea geothermal and other renewable resources from the Imperial Valley area to the load centers in Southern California. This project is a joint project with Los Angles Department of Water and Power (LADWP), Imperial Irrigation District (IID) and Southern California Public Power Authority (SCPPA) member cities. This project calls for construction of a double circuit 230 kVAC, 85-mile transmission line with an approximately 10-mile underground portion. This line is planned to originate at Devers substation near Palm Springs,

California and terminate at Hesperia substation near the City of Hesperia, California. The projected completion date of this project is late 2014.

GPNP Transmission Project One-Line Diagram



This one-line diagram above shows the Green Path North Project in relation to other power system interconnections and geothermal resource in Imperial Valley. Several routing alternatives are under consideration for GPNP as shown in the attached map below. The transmission components that were evaluated with the RETI environmental screening process included transmission segments associated with the routing alternative A. In addition to the routing alternative A, five additional routings are being studied in the formal environmental review process for this project.



Conceptual Segments in Southern California Edison Service Territory

1. CONT_LUGO Project

i. CONT_LPIN_1

This 57 mile 500 kV single circuit line (initially operated at 230 kV) connects Control 500/230/115 kV substation to new Lone Pine 500/230 kV substation. The line is planned to access geothermal CREZs in northern and central Nevada as well as renewable resources at Control substation.

ii. LPIN_INYK_1

This 53 mile 500 kV single circuit line (initially operated at 230 kV) connects new Lone Pine 500/230 kV substation to Inyokern 500/230/115 kV substation.

iii. INYK_KRAM_1

This 66 mile 500 kV single circuit line (initially operated at 230 kV) connects Inyokern 500/230/115 kV substation to Kramer 500/230/115 kV substation.

iv. KRAM_LUGO_1

This 48 mile 500 kV single circuit line connects Kramer 500/230/115 kV substation to Lugo 500/230 kV substation. The line is a major network line.

2. KRAM_WWND_1 Project

i. KRAM_WHUB_1

This 45 mile 500 kV single circuit line connects Kramer 500/230/115 kV substation to Windhub 500/230 kV substation. The line is a major network line.

ii. WHUB_WRLW_1

This 15 mile 500 kV single circuit line connects Wind Hub 500/230 kV to Whirlwind 500/230 kV substation. The line is a major network line.

3. MTPS_LUG Project

i. MTPS1_BAKR1_1

This 55 mile 500 kV single circuit line connects Mountain Pass 500/115 kV substation to Baker 500/115 kV substation. The line is planned to access CREZs in the Mountain Pass area.

ii. BAKR1_BARS1_1

This 50 mile 500 kV single circuit line connects Baker 500/115 kV substation with Barstow 500 kV substation. The line is planned to access CREZs in the Baker area.

iii. BARS1_LUGO_1

This 51 mile 500 kV single circuit line connects Barstow 500 kV substation with Lugo 500/230 kV substation. The line is planned to access CREZs in the Barstow area.

4. MTPS_ELDO

i. MTPS_ELDO_1

This 32 mile 500 kV single circuit line connects Mountain Pass 500/115 kV substation to Eldorado 500/230/115 kV substation. The line is planned to access CREZs in the Mountain Pass area and transfers the power to California via Eldorado 500 kV substation.

5. IRMT_PIS_MIR

i. SCEJ_CAMI_1

This 10 mile 500 kV single circuit line connects the new SCE Junction 500 kV substation to Camino 500/230 kV substation. The line is planned to access CREZs in the Needles area.

ii. IRMT_SCEJ_1

This 39 mile 500 kV double circuit line (circuit #1) connects Iron Mountain 500/230 kV substation to new SCE Junction 500 kV substation. The line is planned to access CREZs in the Iron Mountain area.

iii. IRMT_SCEJ_2

This 39 mile 500 kV double circuit line (circuit #2) connects Iron Mountain 500/230 kV substation to new SCE Junction 500 kV substation. The line is planned to access CREZs in the Iron Mountain area.

iv. SCEJ_PISG_1

This 84 mile 500 kV double circuit line (circuit #1) connects SCE Junction 500 kV substation to Pisgah 500/230 kV substation. The line is planned to transfer power from CREZs at Iron Mountain and Needles to Pisgah substation.

v. SCEJ_PISG_2

This 84 mile 500 kV double circuit line (circuit #2) connects SCE Junction 500 kV substation to Pisgah 500/230 kV substation. The line is planned to transfer power from CREZs at Iron Mountain and Needles to Pisgah substation.

vi. PISG_MIRA_1

This 97 mile 500 kV single circuit line connects Pisgah 500/230 kV substation to Mira Loma 500/230 kV substation. This major network line also connects to Lugo via the Pisgah-San Bernardino Lucerne-Lugo 500 kV line, thus forming a network between Lugo, Mira Loma and Pisgah. The line is planned to transfer power from CREZs at Pisgah, Mountain Pass, Iron Mountain, Needles, and San Bernardino-Lucerne.

6. PIS_LUC_LUG

i. PISG_LUCV_1

This 47 mile 500 kV single circuit line connects Pisgah 500/230 kV substation to Lucerne 500 kV substation. This line is also part of the Pisgah-San Bernardino Lucerne-Lugo 500 kV lines network. The line is planned to transfer power from CREZs at Pisgah, Mountain Pass, Iron Mountain, Needles, and San Bernardino-Lucerne.

ii. LUCV_LUGO_1

This 21 mile 500 kV single circuit line connects Lucerne 500 kV substation to Lugo 500/230 kV substation. This line is also part of the Pisgah-San Bernardino Lucerne-Lugo 500 kV lines network. The line is planned to transfer power from CREZs at Pisgah, Mountain Pass, Iron Mountain, Needles, and San Bernardino-Lucerne.

7. EGM_DSC

i. JULH_DESC_1

This 20 mile 230 kV double circuit line (circuit #1) connects Julian Hinds 230 kV substation to Desert Center 500/230 kV substation. The line is planned to transfer power from CREZs at Eagle Mountain, part of Riverside East CREZ to Desert Center substation.

ii. JULH_DESC_2

This 20 mile 230 kV double circuit line (circuit #2) connects Julian Hinds 230 kV substation to Desert Center 500/230 kV substation. The line is planned to transfer power from CREZs at Eagle Mountain, part of Riverside East CREZ to Desert Center substation.

iii. JULH_EGMT_1

This 15 mile 230 kV double circuit line (circuit #1) connects Julian Hinds 230 kV substation to Eagle Mountain 230/161 kV substation. The line is planned to transfer power from CREZs at Eagle Mountain, part of Riverside East CREZ to Julian Hinds substation.

iv. JULH_EGMT_2

This 15 mile 230 kV double circuit line (circuit #2) connects Julian Hinds 230 kV substation to Eagle Mountain 230/161 kV substation. The line is planned to transfer power from CREZs at Eagle Mountain, part of Riverside East CREZ to Julian Hinds substation.

8. MDPT_DSC_VAL

i. MIDP_DESC_1

This 50 mile RETI 500 kV single circuit line connecting new Mid Point 500 kV substation with Desert Center 500/230 kV Substation has been dropped and has been replaced by SCE proposed Mid Point-Devers-Valley 500 kV line No.2 (California portion of the old DPV2 project). The line is planned to access CREZs from the Riverside East area.

ii. DESC_DEVR_1

This 68 mile 500 kV single circuit line connects Desert Center 500/230 kV substation to Devers 500/230/115 kV substation and represents the third 500 kV line in the Devers-Palo Verde

corridor, in addition to the existing Palo Verde-Devers 500 kV line #1 and the planned Mid Point-Devers 500 kV line #2, between Desert Center and Devers substations. The line is planned to transfer power from CREZs at Mid Point and Eagle Mountain, part of Riverside East CREZs, to Devers Substation.

iii. DEVR_VALL_3

This 40 mile 500 kV single circuit line (circuit #3) connects Devers 500/230/115 kV substation to Valley 500/115 kV substation. The line is planned to transfer power from CREZs at Mid Point, Eagle Mountain, Imperial North, Imperial South, Imperial East, and Baja to Valley substation.

9. TEHACHAPI

Tehachapi segments 1-3 are under construction. This section describes the remaining segments of this project.

• Segment 4 - Construction of the new Whirlwind Substation in Kern County west of Rosamond. This 500/220 kV substation would be connected to the proposed Cottonwind Substation1 by a new four-mile double-circuit, 220 kilovolt (kV) transmission line and to SCE's existing Antelope Substation in west Lancaster by a new 14- mile 500 kV transmission line. Construction would be in a new ROW, parallel to the existing ROW.

• Segment 5 - Construction of a new 18- mile-long 500 kV transmission line that would connect SCE's existing Antelope Substation with SCE's existing Vincent Substation near Acton. This new line would be built next to an identical existing 500 kV ine and would replace two 220 kV lines that would be removed. An existing ROW would be utilized. This new line would be initially energized at 220 kV.

• Segment 6 - Replacement of approximately 27 miles of an existing 220 kV transmission line that runs from SCE's existing Vincent Substation to the southern edge of the Angeles National Forest (ANF) near the city of Duarte with a new 500 kV transmission line that would initially be energized at 220 kV. An existing ROW would be utilized. Replacement of approximately five miles of an existing SCE 220 kV transmission line between Vincent Substation and the northern border of the ANF with a new 500 kV transmission line.

• Segment 7 - Replacement of 15 miles of the existing 220 kV line from the ANF border near the city of Duarte south to SCE's existing Rio Hondo Substation in the city of Irwindale and then continuing southwest across various San Gabriel Valley cities toward SCE's existing Mesa Substation in the Monterey Park/Montebello area with a double-circuit, 500 kV transmission line. Existing ROWs would be utilized and various lower-voltage subtransmission lines between

the Rio Hondo and Mesa Substations would require relocation within existing ROW or public ROW.

• Segment 8 - Replacement of existing single-circuit, 220 kV line that runs from the existing Mesa Substation area to the Chino Substation area and existing doublecircuit, 220 kV line from Chino Substation to the existing Mira Loma Substation with a 32-mile double-circuit, 500 kV line. Replacement of approximately seven miles of existing 220 kV line that run from SCE's Chino Substation to its Mira Loma Substation located in the city of Ontario with a double-circuit, 220 kV line. Existing ROWs would be utilized except for where approximately three miles of new ROW would be required in limited areas. Various lower-voltage sub-transmission lines in the Chino area would require relocation within existing ROW or public ROW.

• Segment 9 - Installation of equipment and upgrades at Antelope, Vincent, Windhub and Whirlwind Substations to connect new 220 kV and 500 kV transmission lines and to help maintain proper voltage levels.

• Segment 10 - Construction of a new 12- mile, single-circuit, 500kV line to connect the proposed Whirlwind Substation (Segment 4) with the Windhub2 collector substation. New ROW would be required.

• Segment 11 - Replacement of approximately 20 miles of 220 kV transmission line between the existing Vincent Substation and Gould Substation near La Cañada Flintridge with a new, 20-mile, single-circuit, 500 kV transmission line. Installation of a second 220 kV transmission line on the currently empty side of the transmission towers that already extend from the area of Gould Substation across various San Gabriel Valley cities to the area of Mesa Substation in Monterey Park. An existing ROW would be utilized.

*Segment 1 was originally filed as Antelope Pardee Transmission Line.

** Segments 2 and 3 were originally filed as Antelope Transmission Project.

1 - Cottonwind Substation is currently undergoing environmental review by the County of Kern in conjunction with a proposed wind farm development under an existing application.

2 - Substation One (Windhub) was included in SCE's proposed Antelope Transmission Project Segment 2-3 application (A.04-12-008) submitted to the California Public Utilities Commission for approval in December 2004 and amended September 30, 2005.

II. Central California and North Segments

Pacific Gas & Electric Service Territory

Carrizo Area Upgrades

The electric transmission system in the Los Padres area will require incremental upgrades to accommodate development of the Carrizo A, B and Santa Barbara CREZs. The following rough outline of needs will provide for development of up to 3000 MW from these CREZs.

-The first 1100 MW of renewables connected to the proposed Carrizo switching station on the Midway – Morro Bay 230 kV lines will require reconductoring of the Carrizo – Midway section of these 230 kV lines.

-Reconductoring the Morro Bay – Gates 230 kV lines will provide for the next 1000 MW of development in this area.

-A final 1000 MW of capacity will require a new line to the bulk system. A new Carrizo – Gates 230 kV line would meet this need.

South – to – North Bulk System Upgrades

The ability to transmit renewable power from southern California resources to the northern section of the state will require incremental upgrades to the WECC designated Paths 15 and 26 and connected lines. Current use of this pathway is limited by the Midway – Gates 500 kV line which is located between Paths 15 and 26. Incremental increases in south-to-north transfer capability are to be provided from the following upgrades:

-Construct a double circuit, 500 kV line between Midway and Gregg. This will add 1250 MW of south-to-north capacity by strengthening the limiting Midway – Gates section.

-Construct a double circuit, 500 kV line between Gregg and the Bay Area by connecting to the proposed Alpha 4 substation and modify TANC's Alpha Project 500 kV line from Tracy to Alpha 4 from single circuit tower line to a double circuit tower line. This line will strengthen the bulk system north of Path 15 and increase the south-to-north transfer capability north of Midway by an additional1250 MW.

- Reconductor the Midway – Vincent 500 kV #3 line.

- Construct a double circuit 500 kV line from Midway to Kramer, to connect the outer southern California bulk system ring north to Midway. This would increase the South – North Capability over Path 15 by about another 1000 MW.

The British Columbia - California Project involves the construction of an approximate 1000 mile HVAC and HVDC transmission project from British Columbia to Northern California and interconnects with five or six existing and proposed substations (interconnection substations).

This Project is intended to meet three primary objectives:

1. Enhance access to significant incremental renewable resources in Canada and the

Pacific Northwest.

2. Improve regional transmission reliability.

3. Provide market participants with beneficial opportunities to use the facilities

Specifically the proposed project is as follows:

a) A series compensated (up to 70%) 500 kV HVAC Double Circuit Tower Line (DCTL) from Selkirk Substation in the southeast British Columbia to Devil's Gap near Spokane, Washington and then to the proposed Northeast Oregon (NEO) Station and string 4-conductor bundled 666 kcmil ACSR. (Northern Segment)

b) A 3000 MVA, 500 kV HVAC to +/-500 kV HVDC Converter at the NEO Station.

c) A +/-500 kV HVDC line from the NEO Station to the proposed Collinsville Substation in the San Francisco Bay Area and string 3-conductor bundle 1272 kcmil ACSR. (Southern Segment)

d) A 3000 MVA, 500 kV HVAC to +/-500 kV HVDC Converter at Collinsville Substation.

e) +/- 600 MVAR Static VAR Compensators at each of the interconnection substations: Selkirk, Devil's Gap, Neo Station, Collinsville, Tracy and Cottonwood Area (if installed).

Potential Third Terminal

f) A third HVDC terminal may be installed in the Cottonwood area in northern California consisting of a 1000-1500 MVA, 500 kV HVAC to +/- 500 kV HVDC Converter. This potential terminal could be installed at the same time as or after part of or after the CNC Project is in operation.

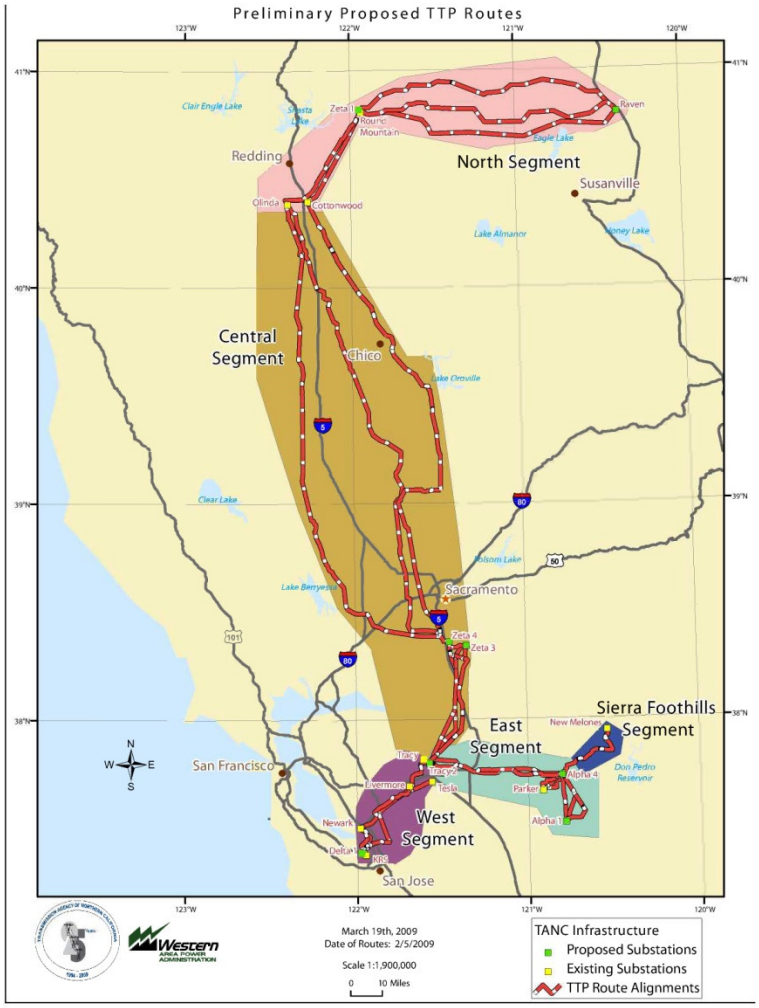
Transmission Agency of Northern California (TANC)

TANC Transmission Project (TTP)

Project Description: See Map 1

The TTP would include building and upgrading about 600 miles of 230-kilovolt (kV) and 500-kV transmission lines, substations, and related facilities. It would consist of five segments of transmission line corridor that extend from northeastern California through the Central Valley and split westward to the San Francisco Bay area and eastward to the Sierra Foothills. The proposed corridors have been identified to avoid, to the extent possible, residential and known environmentally-sensitive areas, and to take advantage of accessible competitive renewable energy zones, as recommended by the State of California's Renewable Energy Transmission Initiative. The proposed segments are further identified as: North Segment, Central Segment, West Segment, East Segment, and Sierra Foothills Segment.

Map 1

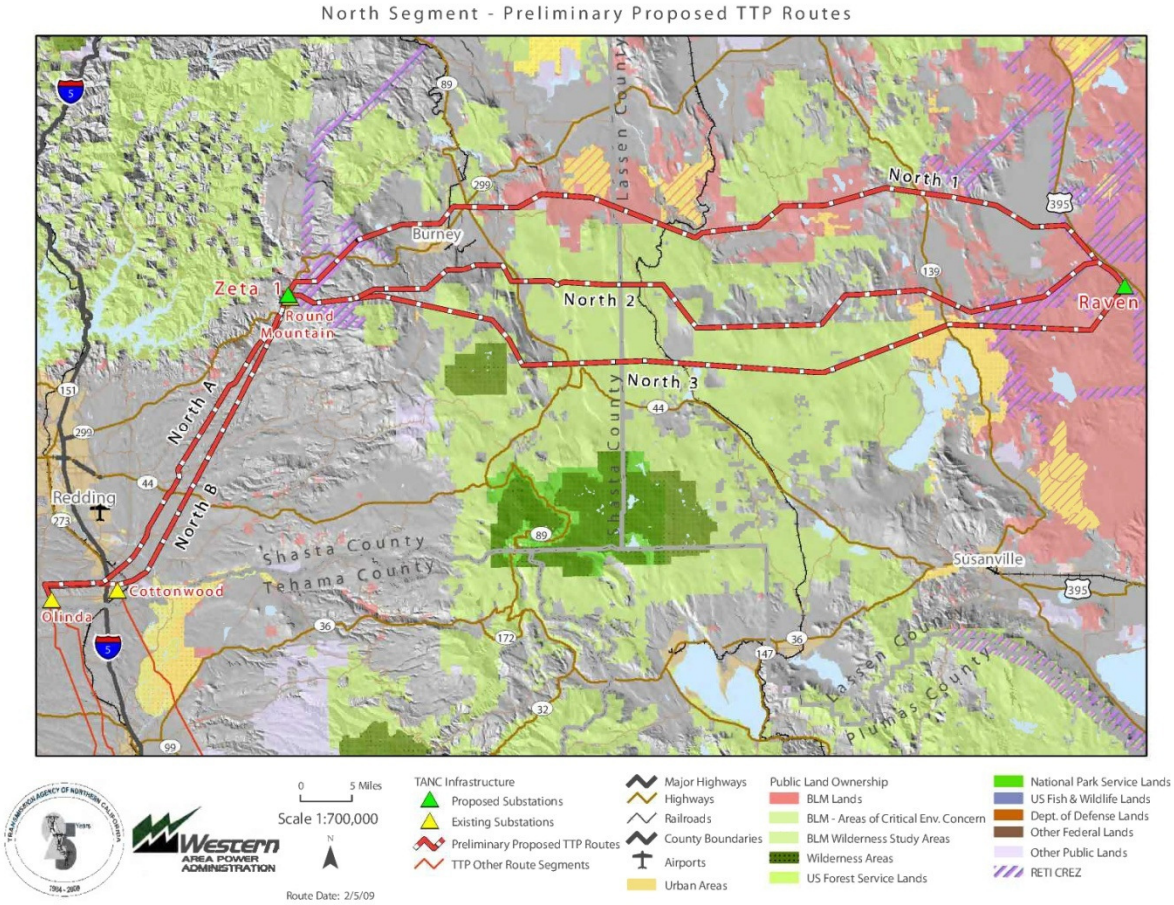


North Segment: See Map 2

The North Segment would include two, new, single-circuit, 500-kV transmission lines, each extending west from a proposed new substation near Ravendale to a proposed new substation near the Round Mountain Substation. Three corridor alternatives, each 80 to 100 miles long, have been preliminarily identified. The main purpose of these two lines in the North Segment is to connect the Lassen County North and South CREZ's to the bulk power system. The two lines are required for reliability so that the power system can withstand the loss of one of the lines without overloading the other line, or requiring the need for a remedial action scheme and generation dropping.

The North Segment would also include a new, 1-mile, single-circuit, 500-kV transmission line to interconnect the proposed new substation to the Round Mountain Substation. This new substation would serve as the connection point for the Round Mountain CREZ's. The North Segment would then continue with a new, double-circuit, 500-kV transmission line that would extend 40 to 45 miles southwest to Olinda Substation, south of the City of Redding. These lines connect the resources from the Lassen CREZ's to the Olinda Substation.

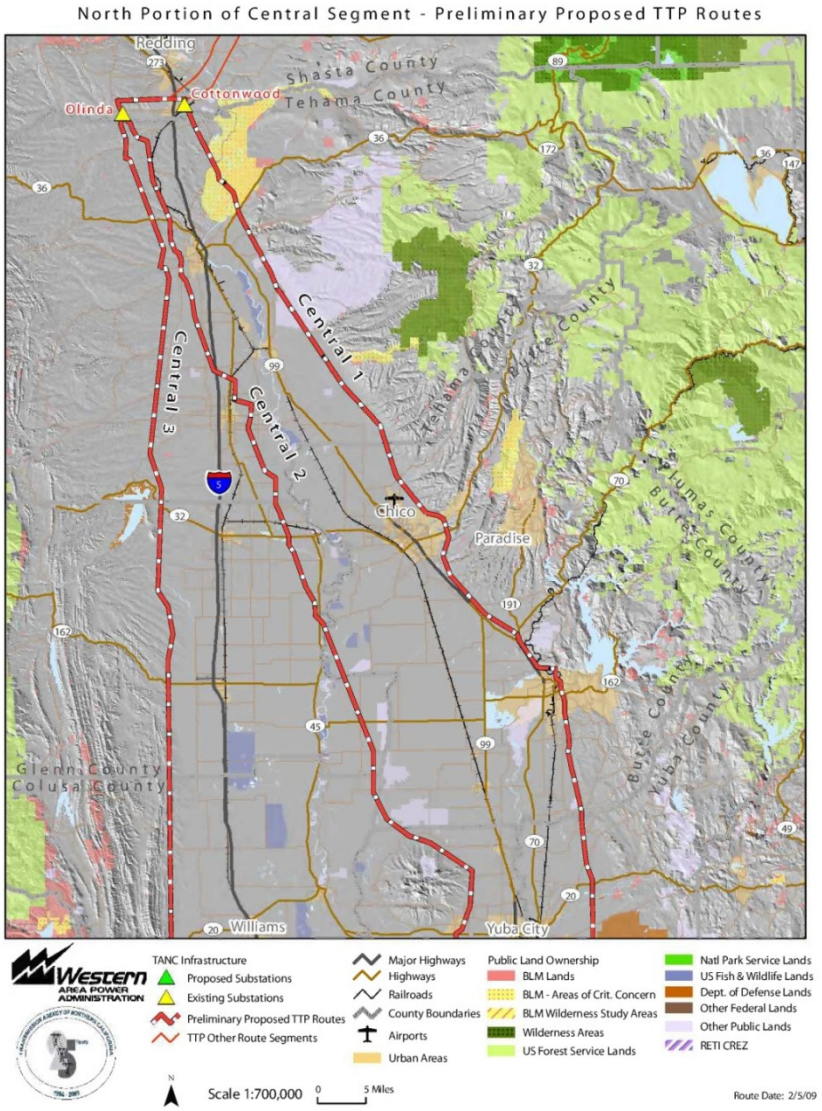
Map 2



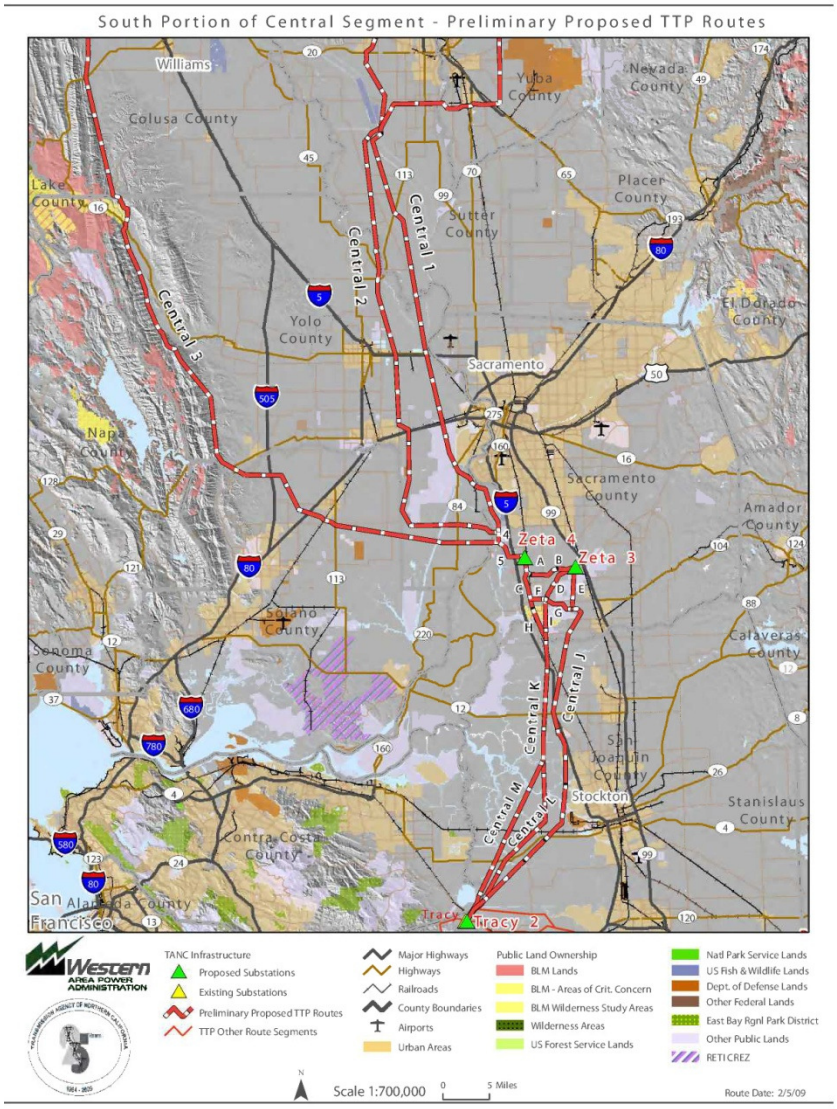
Central Segment: See Map 3 and Map 4

The Central Segment would begin at the Olinda Substation and extend south to Tracy. It would include a new, 160 to 180 mile, double-circuit, 500-kV transmission line through the Central Valley, with an interconnection to a new substation in southern Sacramento County. Three alternative corridors have been preliminarily identified for the Central Segment: the western, central, and eastern alternatives. From the proposed new substation in southern Sacramento County, each of three alternative corridors would continue 40 to 45 miles southwest to a proposed new substation near the Tracy Substation. The purpose of this line is to connect the bulk power system to the Sacramento service area to provide connection to the renewable energy in Lassen and Round Mountain. This will assist SMUD meet the green house gasses reduction and the renewable portfolio standards of 33-percent.

Map 3



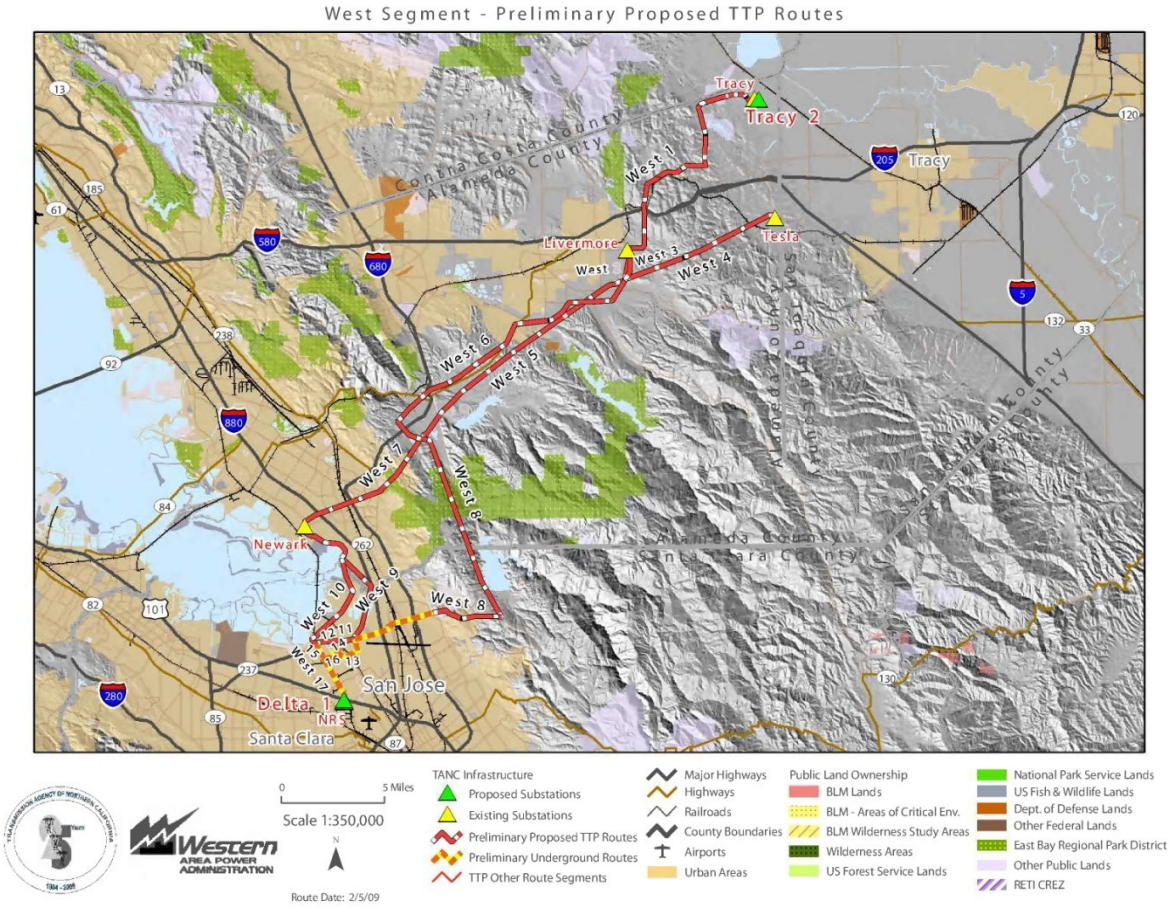
Map 4



West Segment: See Map 5

The West Segment would include a double-circuit, 230-kV transmission line from the Tracy area to the South San Francisco Bay Area. The West Segment would include the rebuilding an existing single-circuit transmission line from Tracy to Livermore substation as a double-circuit line, where it would join a newly constructed single-circuit transmission line from the Tesla to the Livermore Substation area. The double-circuit transmission line would then run to the Newark substation area where one single-circuit line would terminate and the second single-circuit line would continue to a proposed new substation near the Kifer Receiving Station in Santa Clara. Two alternative corridors have been preliminary identified for this transmission line. These lines will allow delivery of renewable energy to the bay area.

Map 5



East Segment: See Map 6

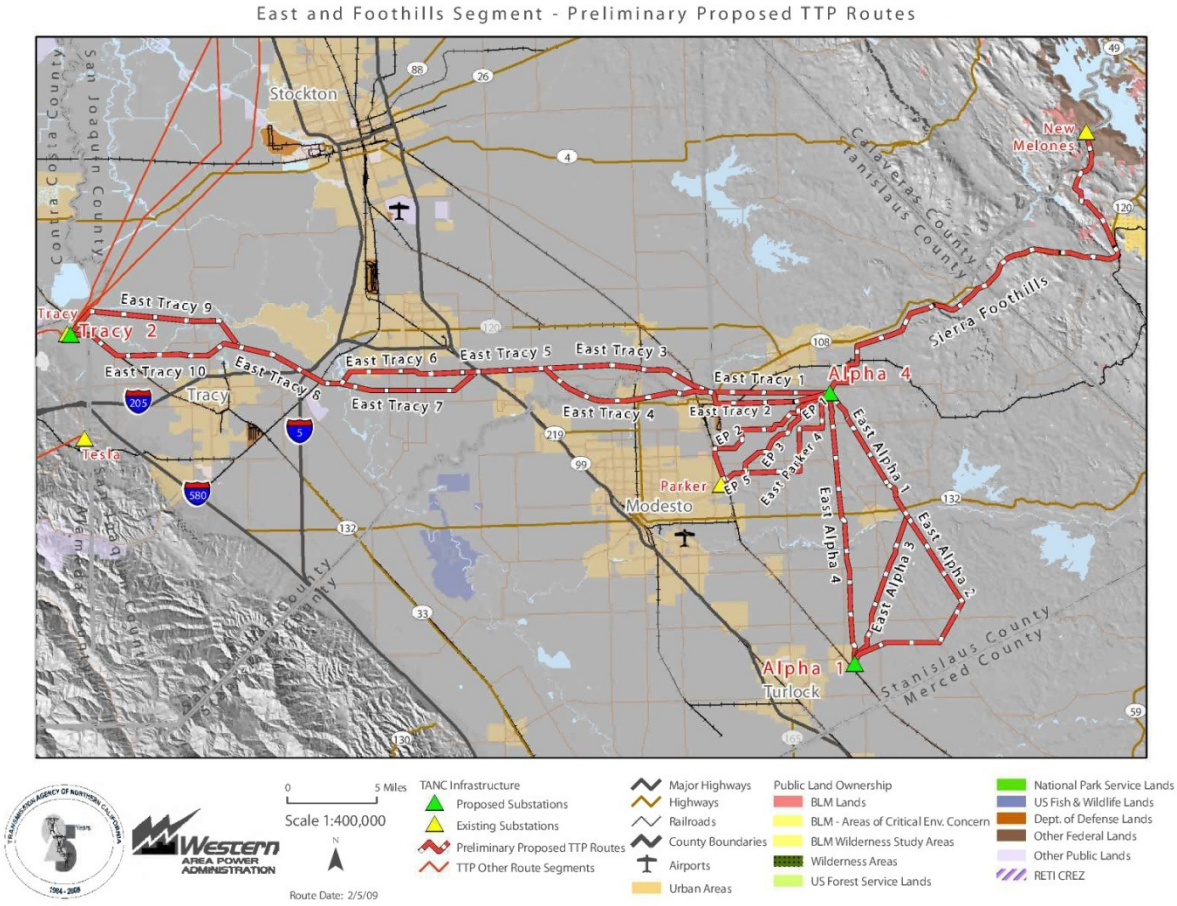
The East segment would include building 40 to 45 miles of new, double-circuit, 500-kV transmission line east from the new substation near Tracy to a proposed substation located south of the Oakdale Airport. The primary purpose of this line is to deliver renewable energy from the Tracy area to the customer service areas of Modesto and Turlock. Two corridor alternatives have been preliminarily identified for the proposed 500-kV transmission line. From the new substation, the East Segment would split into two alignments: a 7 to 11 mile, double-circuit, 230-kV transmission line would run to the Parker Substation in Modesto, thus providing for deliveries of renewable energy to Modesto; and a 15 to 22 mile, double-circuit, 230-kV line would run to a proposed new substation located east of Turlock, thus providing for deliveries of renewable energy to Turlock. Three corridor alternatives have been preliminarily identified for each of the two, proposed, 230-kV transmission lines.

Sierra Foothills Segment: See Map 6

The Sierra Foothills Segment would include a new, double-circuit, 230-kV transmission line, approximately 28 miles long. It would originate at the proposed substation near the Oakdale

Airport and extend through the Sierra Foothills to Western's existing substation at the New Melones Dam. Alternative corridors for this segment have not been identified at this time.

Map 6



Appendix H. Line Segment Data

Line Segment Short Name	Length (Miles)	Cost ($Million)	On-line Date	Enviro Score
ALPH4_ALPH1_1	22	$34.4	2014	80
ALPH4_ALPH1_2	22	$34.4	2014	1
ALPH4_PARK_1	11	$17.2	2014	80
ALPH4_PARK_2	11	$17.2	2014	1
ANTE_VINC_1	18	$69.8	2013	2
AV58_CHCV_1	17.5	$32.8	2014	4
BAKR1_BARS1_1	50	$193.8	2015	48
BANN_AV58_1	61	$107.4	2014	36
BANN_CHCV_1	56.2	$140.2	2014	36
BANN_DEVR_1	91.2	$296.4	2020	216
BANN_ELCN_1	27.5	$51.6	2013	16
BANN_GEO_1	16	$25.0	2013	120
BANN_GEO_2	16	$25.0	2013	1
BARS1_LUGO_1	51	$286.9	2015	108
BRNR_HASC_1	60	$40.5	2013	72
BRNR_HASC_2	60	$150.0	2013	3
CAST_HASC_2	12	$7.5	2013	1
CHCV_DVR2_1	35	$54.7	2014	72
CHCV_DVR2_2	35	$54.7	2014	2
CHCV_MIRG_1	20	$13.5	2013	3
CHCV_MIRG_2	20	$13.5	2013	3
CHNO_MESA_1	23	$79.1	2013	8
CHNO_MIRA_1	7	$24.1	2013	8
CHNO_MIRA_2	7	$15.3	2013	1
CHNO_MIRA_3	7	$15.3	2013	1
CMPL_ECND_1	37	$25.0	2013	2
CMPL_ECND_2	37	$23.1	2013	2
CMPL_TALG_1	10	$6.8	2013	1
CMPL_TALG_2	10	$6.3	2013	1
COLL_PITT_1	1	$1.6	2020	40
COLL_PITT_2	1	$1.6	2020	1
COLL_TRCY2_1	40	$130.0	2020	96
CONT_LPIN_1	45	$202.5	2015	4
DESC_DEVR_1	40	$125.0	2013	72
DESC_DEVR_2	40	$125.0	2013	3
DEVR_DVR2_1	0.3	$1.0	2014	12

Line Segment Short Name	Length (Miles)	Cost ($Million)	On-line Date	Enviro Score
DEVR_VALL_2	40	$130.0	2013	48
DEVR_VALL_3	40	$300.0	2020	12
DILL_TRCY2_1	43	$139.8	2014	144
DIXL_BANN_1	43	$51.6	2013	8
DRTE_MIRA_1	43	$147.8	2013	8
DRTE_RIOH_1	5	$17.2	2013	1
DVR2_CENT_1	175	$308.2	2014	288
DVR2_VICT_1	133	$279.8	2014	150
EGM2_DEVR_1	77	$240.6	2020	216
EGM2_DEVR_2	77	$240.6	2020	3
EGM2_EGMT_1	1	$1.6	2020	48
EGM2_EGMT_2	1	$1.6	2020	1
ELCN_HILN_1	19	$35.6	2013	4
ELCN_HILN_2	19	$35.6	2013	1
ELCN_IMPV2_2	18	$33.8	2013	4
GATE_MBAY_1	70	$47.3	2012	12
GOOD_MESA_1	8	$5.0	2013	2
GREG_ALPH4_1	100	$312.5	2016	144
GREG_ALPH4_2	100	$312.5	2016	3
GULD_GOOD_1	17	$10.6	2013	2
HASC_RNLD_1	15	$10.1	2013	1
IMPV_BANN_1	51	$165.8	2020	216
IMPV_XFMR_2	0.0246	$51.3	2011	0
IMPV_XFMR_3	0.0246	$51.3	2012	0
INYK_KRAM_1	66	$214.5	2015	72
IRMT_SCEJ_1	39	$134.1	2015	12
IRMT_SCEJ_2	39	$134.1	2020	2
JULH_DESC_1	20	$31.3	2020	24
JULH_DESC_2	20	$31.3	2020	1
JULH_EGMT_1	15	$28.1	2020	2
JULH_EGMT_2	15	$28.1	2020	1
KRAM_LUGO_1	48	$270.0	2015	48
KRAM_WHUB_1	40	$225.0	2015	80
LELK_CMPL_1	31	$100.8	2013	240
LIVR_DELT_1	17	$31.9	2014	144
LPIN_INYK_1	53	$238.5	2015	12
LUCV_LUGO_1	21	$65.6	2015	36
LUGO_VICT_2	24	$78.0	2015	8
MIDP_DESC_1	70	$227.5	2013	48

Line Segment Short Name	Length (Miles)	Cost ($Million)	On-line Date	Enviro Score
MIDW_CARZ_1	46	$31.1	2011	8
MIDW_GEO_1	16	$25.0	2012	80
MIDW_GEO_2	16	$25.0	2012	1
MIDW_GREG_1	141	$440.6	2016	192
MIDW_GREG_2	141	$440.6	2016	4
MIDW_KRAM_1	118	$368.8	2015	144
MIDW_KRAM_2	118	$368.8	2015	4
MIDW_WRLW_1	52.5	$79.7	2013	36
MIRG_DEVR_1	15	$10.1	2013	1
MIRG_DEVR_2	15	$10.1	2013	1
MTPS1_BAKR1_1	50	$193.8	2015	48
MTPS1_ELDO_1	32	$124.0	2012	48
NEO_COLL_1	640	$2,080.0	2020	180
OLND_DILL_1	183	$594.8	2014	480
PISG_LUCV_1	47	$146.9	2015	216
PISG_MIRA_1	97	$375.6	2014	144
RIOH_MESA_1	12	$41.3	2013	12
SCEJ_CAMI_1	10	$38.8	2015	6
SCEJ_PISG_1	84	$262.5	2015	108
SCEJ_PISG_2	84	$262.5	2020	3
SELK_NEO_1	270	$843.8	2020	120
SELK_NEO_2	270	$843.8	2020	5
TESL_NEWK_1	29	$54.4	2014	32
TRCY2_LIVR_1	45	$140.6	2014	4
TRCY2_ALPH4_1	45	$140.6	2014	160
TRCY2_ALPH4_2	13	$24.4	2016	2
TRCY2_TRCY_1	1	$3.3	2014	8
VINC_DRTE_1	27	$121.5	2013	8
VINC_GULD_1	20	$77.5	2013	8
WHUB_WRLW_1	15	$48.8	2013	12
WRLW_ANTE_1	17	$55.3	2013	24
ZETA1_OLND_1	42	$136.5	2014	96
ZETA1_RDMT_1	1	$3.3	2014	24

Appendix I. List of Component Facilities

New Substations and Network Upgrades	Upgrade Identification Name	Short Name
Build new 230 kV Alpha 4-Alpha 1 #1 line (22 miles)	Alpha4-Alpha1_1	ALPH4_ALPH1_1
Build new 230 kV Alpha 4-Alpha 1 #2 line (22 miles)	Alpha4-Alpha1_2	ALPH4_ALPH1_2
Build new 230 kV Alpha 4-Parker #1 line (11 miles)	Alpha4-Parker_1	ALPH4_PARK_1
Build new 230 kV Alpha 4-Parker #2 line (11 miles)	Alpha4-Parker_2	ALPH4_PARK_2
500 kV replacement of existing 220 kV line to create new 500 kV Antelope-Vincent #1 line (18 miles) (segment 5)	Antelope-Vincent_1_replace	ANTE_VINC_1
Rebuild existing Avenue 58-Coachella Valley 161 kV line from Avenue 58 substation to Coachella Valley substation with double-circuit 230 kV towers to create a 230 kV Avenue 58-Coachella Valley #1 line (17.5 miles)	Ave58-CoachellaValley_1_rebuild	AV58_CHCV_1
Replace existing Coolwater-Black Mountain lines with new 500 kV Baker1-Barstow1 #1 line (42 miles) between Baker and Barstow.	Baker1_Barstow1_replace	BAKR1_BARS1_1
Rebuild existing El Centro-Avenue 58 161 kV line from Avenue 58 substation south as far as Bannister with double-circuit 230 kV towers and connect rebuilt line to Bannister substation creating a 230 kV Bannister-Avenue 58 #1 line (61 miles)	Bannister-Ave58_1_rebuild	BANN_AV58_1
Add 230 kV Bannister-Coachella Valley #1 line on open side of new 230 kV structures (56.2 miles)	Bannister-CoachellaValley_1	BANN_CHCV_1
Add 500 kV Bannister-Devers #1 line (91.2 miles)	Bannister_Devers_1	BANN_DEVR_1
Add 230 kV Bannister-El Centro #1 line on open side of new towers (27.5 miles)	Bannister-ElCentro_1	BANN_ELCN_1
Add 230 kV Bannister-Geo #1 line (16 miles)	Bannister-Geo_1	BANN_GEO_1
Add 230 kV Bannister-Geo #2 line (16 miles)	Bannister-Geo_2	BANN_GEO_2
Add 500/230 kV transformation capability at Bannister substation (one transformer)	Bannister_xfmr_1	BANN_XFMR_1
Add 500/230 kV transformation capability at Bannister substation (one transformer)	Bannister_xfmr_2	BANN_XFMR_2
Add 500/230 kV transformation capability at Bannister substation (one transformer)	Bannister_xfmr_3	BANN_XFMR_3
Build new 500 kV Barstow1-Lugo #1 line with double circuit towers (52 miles)	Barstow1_Lugo_1	BARS1_LUGO_1
Upgrade existing 230 kV Owens Gorge-Rinaldi line from Barren Ridge Switching Station to Haskell Canyon switching station (60 miles)	BarrenRidge-HaskellCanyon_upgrade	BRNR_HASC_1
Build 230 kV Barren Ridge Switching Station-Haskell Canyon #2 line with double circuit towers (60 miles)	BarrenRidge-HaskellCanyon_2	BRNR_HASC_2
Add 230 kV Castaic Power Plant-Haskell Canyon #2 line on open side of towers (12 miles)	Castaic_HaskellCanyon_2	CAST_HASC_2
Add Coachella Valley-DeversII 230 kV line #1 (35 miles)	CoachellaValley-DeversII_1	CHCV_DVR2_1
Add Coachella Valley-DeversII 230 kV line #2 (35 miles)	CoachellaValley-DeversII_2	CHCV_DVR2_2
Upgrade existing 230 kV Coachella Valley-Mirage #1 (20 miles)	CoachellaValley-Mirage_1_upgrade	CHCV_MIRG_1
Upgrade existing 230 kV Coachella Valley-Mirage #2 (20 miles)	CoachellaValley-Mirage_2_upgrade	CHCV_MIRG_2
Add new 500 kV Mesa-Chino #1 line on open side of new towers. (23 miles) (segment 8A)	Chino-Mesa_1	CHNO_MESA_1

New Substations and Network Upgrades	Upgrade Identification Name	Short Name
Add new 500 kV Chino-Mira Loma #1 line on open side of new towers. (7 miles) (segment 8A)	Chino-MiraLoma_1	CHNO_MIRA_1
Replace two existing single-circuit 220 kV lines with new double-circuit 220 kV towers creating new 220 kV Chino-Mira Loma #2 line. Requires relocating several existing 66 kV lines near Chino substation. (7 miles) (segment 8B)	Chino-MiraLoma_2_replace	CHNO_MIRA_2
Add new 220 kV Chino-Mira Loma #3 line on open side of new towers. (7 miles) (segment 8B)	Chino-MiraLoma_3	CHNO_MIRA_3
Reconductor existing 230 kV Talega-Escondido #1 line between Escondido and new Camp Pendleton substation (30 miles)	CampPendleton-Escondido_upgrade	CMPL_ECND_1
Add new 230 kV Camp Pendleton-Escondido #1 line on open side of existing towers (37 miles)	CampPendleton-Escondido_2	CMPL_ECND_2
Reconductor existing 230 kV Talega-Escondido #1 line between Talega and new Camp Pendleton substation (10 miles)	CampPendleton-Talega_upgrade	CMPL_TALG_1
Add new 230 kV Camp Pendleton-Talega #1 line on open side of existing towers (10 miles)	CampPendleton-Talega_2	CMPL_TALG_2
Add 500/230 kV transformer at new Camp Pendleton substation	CampPendleton_xfmr_1	CMPL_XFMR_1
Add 500/230 kV transformer at new Camp Pendleton substation	CampPendleton_xfmr_2	CMPL_XFMR_2
Add 500/230 kV transformer at new Camp Pendleton substation	CampPendleton_xfmr_3	CMPL_XFMR_3
Add 230/230 kV phase shifting transformer at new Camp Pendleton substation	CampPendleton_PSxfmr_1	CMPL_XFPS_1
Add 230/230 kV phase shifting transformer at new Camp Pendleton substation	CampPendleton_PSxfmr_2	CMPL_XFPS_2
Add 230/230 kV phase shifting transformer at new Camp Pendleton substation	CampPendleton_PSxfmr_3	CMPL_XFPS_3
Build Collinsville-Pittsburgh 230 kV line #1 (___ miles)	Collinsville-Pittsburgh_1	COLL_PITT_1
Build Collinsville-Pittsburgh 230 kV line #2 (___ miles)	Collinsville-Pittsburgh_2	COLL_PITT_2
Build new Collinsville-Tracy area 500 kV line (____ miles)	Collinsville-Tracy_1	COLL_TRCY_1
Replace two existing 115 kV Control-Inyokern lines between Control and new Lone Pine substation with a new 230 kV Control-Lone Pine #1 line built to 500 kV specifications (50 miles)	Control-LonePine_1_rebuild	CONT_LPIN_1
Build 500 kV Desert Center-Devers #1 line (68 miles) on double circuit towers	DesertCenter-Devers_1	DESC_DEVR_1
Connect Devers and DeversII substations with a 500 kV tie (0.3 miles)	Devers-DeversII_1	DEVR_DVR2_1
Add new 500 kV Devers-Valley #2 line (42 miles)	Devers_Valley_2	DEVR_VALL_2
Add a 500 kV Devers-Valley #3 line by replacing the existing Devers-Valley #1 towers with double circuit towers and stringing the third line on the open side of the towers (40 miles)	Devers-Valley_3	DEVR_VALL_3
Build new 500 kV Dillard Road-Tracy2 #1 line (47 miles)	DillardRoad-Tracy2_1	DILL_TRCY2_1
Disconnect Dixieland-El Centro 230 kV line from El Centro substation and rebuild existing El Centro-Avenue 58 161 kV line north as far as Bannister with double-circuit 230 kV towers and connect rebuilt line to Bannister substation creating a Dixieland-Ban	Dixieland-Bannister_rebuild	DIXL_BANN_1

New Substations and Network Upgrades	Upgrade Identification Name	Short Name
(i) Replace existing 220 kV line between new Duarte Tap and Mesa substation area with double-circuit 500 kV towers. (Includes relocation of several 66 kV lines between Rio Hondo and Mesa substations.) (15 miles) (segment 7) + (ii) Replace an existing	DuarteTap-MiraLoma_1_replace	DRTE_MIRA_1
"Using a portion of an existing line", connect Duarte Tap to Rio Hondo substation creating 500 kV Duarte Tap-Rio Hondo #1 line. (5 miles) (segment 6)	DuarteTap-RioHondo_1_reconfig	DRTE_RIOH_1
Build new 230 kV Green Path North #2 line from DeversII to Century 230 kV bus (140 miles) (Includes removing and restringing 28 miles of an existing 287 kV Victorville-Century #2 line and operating restrung line at 230 kV)	DeversII-Century_1	DVR2_CENT_2
Build new 230 kV Green Path North #1 line from DeversII to Victorville 230 kV bus (98 miles) (Includes removing and restringing 70 miles of an existing 287 kV Victorville-Century #2 line and operating restrung line at 230 kV)	DeversII-Victorville_1	DVR2_VICT_1
Build new 500 kV Green Energy Express #1 line from new Eagle MountainII 500 kV bus to existing Devers 500 kV bus on double-circuit towers (70 miles)	EagleMountainII-Devers_1	EGM2_DEVR_1
Build new 500 kV Green Energy Express #2 line from new Eagle MountainII 500 kV bus to existing Devers 500 kV bus on open side of towers (70 miles)	EagleMountainII-Devers_2	EGM2_DEVR_2
Build a new 230 kV Eagle MountainII-Eagle Mountain #1 line on double-circuit towers (1 mile)	EagleMountainII-EagleMountain_1	EGM2_EGMT_1
Add a new 230 kV Eagle MountainII-Eagle Mountain #2 line on open side of towers (1 mile)	EagleMountainII-EagleMountain_2	EGM2_EGMT_2
Rebuild existing El Centro-Pilot Knob 161 kV line east as far as Highline substation with double-circuit 230 kV towers and connect to Highline substation creating 230 kV El Centro-Highline #1 line (19 miles)	ElCentro-Highline_1_upgrade	ELCN_HILN_1
Add 230 kV El Centro-Highline #2 line on open side of new towers (19 miles)	ElCentro-Highline_2	ELCN_HILN_2
Add 230 kV El Centro-Imperial ValleyII #2 line (18 miles)	ElCentro-ImperialValleyII_2	ELCN_IMPV2_2
Reconductor existing Morro Bay-Gates 230 kV line (will accommodate the next 1000 MW of development in this area) (_____ miles)	Gates-MorroBay_1_upgrade	GATE_MBAY_1
Add new 220 kV Goodrich-Mesa #1 line on open side of existing towers. (8 miles) (segment 11)	Goodrich_Mesa_1	GOOD_MESA_1
Build new 500 kV Gregg-Alpha 4 line #1 (90 miles, two 2300 kcmil AAL bundled conductors)	Gregg-Alpha4_1	GREG_ALPH4_1
Build new 500 kV Gregg-Alpha 4 line #2 on the opposite side of the towers (90 miles, two 2300 kcmil AAL bundled conductors)	Gregg-Alpha4_2	GREG_ALPH4_2
Add new 220 kV Gould-Goodrich #1 line on open side of existing towers. (17 miles) (segment 11)	Gould-Goodrich_1	GULD_GOOD_1
Add new 500 kV Palo Verde-Devers #2 line between Harquahala Junction Switchyard and Midpoint substation (112 miles)	Harquahala-Midpoint_1	HARQ_MIDP_1
Upgrade existing 230 kV Owens Gorge-Rinaldi line from Haskell Canyon switching station to Rinaldi (15 miles)	HaskellCanyon_Rinaldi_upgrade	HASC_RNLD_1
Add 500 kV Imperial Valley-Bannister #1 line (51 miles)	ImperialValley_Bannister_1	IMPV_BANN_1
Replace existing 500/230 kV 600 MVA Imperial Valley transformer with a new 1120 MVA transformer	ImperialValley_xfmr_2_upgrade	IMPV_XFMR_2
Add third 500/230 kV Imperial Valley transformer (1120 MVA)	ImperialValley_xfmr_3	IMPV_XFMR_3
Build new 500 kV Inyokern-Kramer #1 line (68 miles)	Inyokern-Kramer_1	INYK_KRAM_1

New Substations and Network Upgrades	Upgrade Identification Name	Short Name
Rebuild existing 230 kV Iron Mountain-Camino line with new double circuit 500 kV towers (39 miles) between Iron Mountain and Jontry Junction creating a 500 kV Iron Mountain-JontryJunction #1 line	IronMountain-JontryJunction_1_rebuild	IRMT_SCEJ_1
Add 500 kV Iron Mountain-Jontry Junction #2 line on open side of towers (39 miles)	IronMountain-JontryJunction_2	IRMT_SCEJ_2
Build new 230 kV Julian Hinds-Desert Center #1 line on double circuit towers (20 miles)	JulianHinds-DesertCenter_1	JULH_DESC_1
Add new 230 kV Julian Hinds-Desert Center #2 line on open side of towers (20 miles)	JulianHinds-DesertCenter_2	JULH_DESC_2
Rebuild existing 230 kV Julian Hinds-Eagle Mountain #1 line with double circuit 230 kV towers (15 miles)	JulianHinds-EagleMountain_1_rebuild	JULH_EGMT_1
Add new 230 kV Julian Hinds-Eagle Mountain #2 line on open side of towers (15 miles)	JulianHinds-EagleMountain_2	JULH_EGMT_2
Build new 500 kV Kramer-Lugo #1 line with double circuit towers (48 miles)	Kramer-Lugo_1	KRAM_LUGO_1
Build new 500 kV Kramer-Whirlwind #1 line with double circuit towers (36 miles)	Kramer-Whirlwind_1	KRAM_WRLW_1
Build new Talega-Escondido/Valley-Serrano 500 kV line (30 miles)	LeeLake-CampPendleton_1	LELK_CMPL_1
Build new 230 kV Livermore-Delta #1 line (43 miles)	Livermore-Delta_1	LIVR_DELT_1
Replace two existing 115 kV Control-Inyokern lines between new Lone Pine substation and Inyokern with a new 230 kV Lone Pine-Inyokern #1 line built to 500 kV specifications (52 miles)	LonePine-Inyokern_1_rebuild	LPIN_INYK_1
Build new 500 kV Lucerne Valley-Lugo #1 line with double circuit towers (24 miles) (Scored as double circuit 500 kV/2)	LucerneValley-Lugo_1	LUCV_LUGO_1
Build Lugo-Victorville 500 kV #2 (13 miles)	Lugo-Victorville_2	LUGO_VICT_2
Build 500 kV SCE Midpoint-Desert Center #1 line (50 miles) on double circuit towers	Midpoint-DesertCenter_1	MIDP_DESC_1
Add new 500 kV Palo Verde-Devers #2 line between Midpoint substation and Devers substation (113 miles)	Midpoint-Devers_2	MIDP_DEVR_2
Reconductor Carrizo-Midway section of existing 230 kV line (will accommodate first 1100 MW of renewables connected to Carrizo switching station) (____ miles)	Midway-Carrizo_1_upgrade	MIDW_CARZ_1
Build new 230 kV Midway-Geo #1 line with double-circuit 230 kV towers (16 miles)	Midway-Geo_1	MIDW_GEO_1
Add 230 kV Midway-Geo #2 line on open side of new 230 kV towers (16 miles)	Midway-Geo_2	MIDW_GEO_2
Construct new 500 kV Midway-Gregg #1 line (140 miles, two 2300 kcmil AAL bundled conductors)	Midway-Gregg_1	MIDW_GREG_1
Construct new 500 kV Midway-Gregg #2 line on the opposite of the towers (140 miles, two 2300 kcmil AAL bundled conductors)	Midway-Gregg_2	MIDW_GREG_2
Build new 500 kV Midway-Kramer #1 line with double circuit towers (135 miles)	Midway-Kramer_1	MIDW_KRAM_1
Add new 500 kV Midway-Kramer #2 line on open side of towers (135 miles)	Midway-Kramer_2	MIDW_KRAM_2
Reconductor the PG&E-owned northern portion of the existing 500 kV Midway-Vincent #3 line between Midway substation and a point 9.78 miles north of new Whirlwind substation (52.5 miles)	Midway-Whirlwind_1_upgrade	MIDW_WRLW_1
Upgrade existing 230 kV Mirage-Devers #1 (15 miles)	Mirage-Devers_1_upgrade	MIRG_DEVR_1
Upgrade existing 230 kV Mirage-Devers #2 (15 miles)	Mirage-Devers_2_upgrade	MIRG_DEVR_2

New Substations and Network Upgrades	Upgrade Identification Name	Short Name
Replace existing 115 kV Coolwater-El Dorado line with new 500 kV Mountain Pass1-Baker1 #1 line (44 miles) between Mountain Pass and Baker.	MountainPass1-Baker1_replace	MTPS1_BAKR1_1
Replace existing 115 kV Coolwater-El Dorado line with new 500 kV Mountain Pass1-El Dorado # 1 line between Mountain Pass and El Dorado.	MountainPass1-ElDorado_1_replace	MTPS1_ELDO_1
Build a new +/- 500 kV DC NEO-Collinsville line (3-conductor bundle 1272 kcmil ACSR (600 miles)	NEO-Collinsville_1	NEO_COLL_1
Build new 500 kV Olinda-Dillard Road #1 line (187 miles)	Olinda-DillardRoad_1	OLND_DILL_1
Build new 500 kV Pisgah-Lucerne Valley #1 line with double circuit towers (85 miles) (Scored as double circuit 500 kV/2)	Pisgah-LucerneValley_1	PISG_LUCV_1
Build new 500 kV Pisgah-Mira Loma #1 line using open side of new towers as far as Lugo substation area (bypassing both Lucerne Valley and Lugo substations) and on new 500 kV double circuit towers between Lugo substation area and Mira Loma (150 miles) (Sco	Pisgah-MiraLoma_1	PISG_MIRA_1
Add new 500 kV Rio Hondo-Mesa #1 line on open side of new towers between Rio Hondo and Mesa substation area (10 miles) (segment 7) and on one side of new towers between Mesa substation area and Mesa substation (2 miles) (segment 7). (Total length = 12 mi	RioHondo-Mesa_1	RIOH_MESA_1
Rebuild existing 230 kV Iron Mountain-Camino line with new 500 kV towers between Jontry Junction and Camino (22 miles) creating a 500 kV Camino-Jontry Junction #1 line	JontryJunction-Camino_1_rebuild	SCEJ_CAMI_1
Build 500 kV Jontry Junction-Pisgah #1 line with double circuit towers (46 miles)	JontryJunction-Pisgah_1	SCEJ_PISG_1
Add 500 kV Jontry Junction-Pisgah #2 line on open side of towers (46 miles)	JontryJunction-Pisgah_2	SCEJ_PISG_2
Build a new series compensated (up to 70%) 500 kV Selkirk-Devil's Gap-NEO line #1 (4-conductor bundled 666 kcmil ACSR) (400 miles)	Selkirk-NEO_1	SELK_NEO_1
Build a new series compensated (up to 70%) 500 kV Selkirk-Devil's Gap-NEO line #2 (4-conductor bundled 666 kcmil ACSR) (400 miles)	Selkirk-NEO_2	SELK_NEO_2
Build new 230 kV Tesla-Newark #1 line (29 miles)	Tesla-Newark_1	TESL_NEWK_1
Build new 230 kV Tracy-Livermore #1 line (13 miles)	Tracy-Livermore_1	TRCY_LIVR_1
Build new 500 kV Tracy2-Alpha 4 #1 line (45 miles)	Tracy2-Alpha4_1	TRCY2_ALPH4_1
Modify towers to accommodate a second 500 kV line and add 500 kV Tracy2-Alpha 4 #2 line on opposite side of towers (45 miles)	Tracy2-Alpha4_2	TRCY2_ALPH4_2
Connect new Tracy2 substation and existing Tracy substation with a short 500 kV line (1 mile)	Tracy2-Tracy_1	TRCY2_TRCY_1
500 kV replacement of existing 220 kV lines to create new 500 kV Vincent-Duarte Tap #1 line. Includes 500 kV replacement of 5 miles of existing 220 kV line between Vincent substation and the northern edge of the Angeles National Forest. (27 miles) (segme	Vincent-DuarteTap_1_replace	VINC_DRTE_1
500 kV replacement of existing 220 kV line to create new 500 kV Vincent-Gould #1 line (20 miles) (segment 11)	Vincent-Gould_1_replace	VINC_GULD_1
Build new 500 kV Whirlwind-Antelope #1 line (14 miles) (segment 4)	Whirlwind-Antelope_1	WRLW_ANTE_1
Build new 500 kV Zeta 1-Olinda #1 line (43 miles)	Zeta1-Olinda_1	ZETA1_OLND_1
Connect new Zeta 1 substation and existing Round Mountain substation with a short 500 kV line (1 mile)	Zeta1-RoundMountain_1	ZETA1_RDMT_1

New Substations and Network Upgrades	Upgrade Identification Name	Short Name
Construct new 230/500 kV Desert Center substation along existing Devers-Palo Verde #1 right-of-way due south of Julian Hinds substation	DesertCenter_sub	0
Loop existing 500 kV Palo Verde-Devers #1 into SCE Midpoint substation creating 500 kV Palo Verde-SCE Midpoint #1 and 500 kV SCE Midpoint-Devers #1	Midpoint_loop-in	0
Expand Devers substation to terminate 500 kV Devers-Valley #3 and 500 kV Imperial Valley-Devers #1 line	Devers_sub_expand	0
Expand Valley substation to terminate 500 kV Devers-Valley #3 line	Valley_sub_expand	0
Upgrade Camino substation with 500 kV capability	Camino_sub_upgrade	0
Upgrade Iron Mountain substation with 500 kV capability	IronMountain_sub_upgrade	0
Construct -100/+500 MVAR SVC at Iron Mountain	IronMountain_SVC	0
Construct new 500 kV JontryJunction switching station between Iron Mountain and Camino substations in the existing Iron Mountain-Camino right-of-way	JontryJunction_sub	0
Construct new Baker1 substation looping in 500 kV rebuild of existing 115 kV Coolwater-El Dorado line	Baker1_sub	0
Construct new Baker2 substation looping in existing 500 kV Adelanto-Marketplace #1 line	Baker2_sub	0
Construct new 500 kV Mountain Pass1 substation looping in 500 kV rebuild of 115 kV Coolwater-El Dorado line	MountainPass1_sub	0
Construct new 287 kV Mountain Pass2 substation looping in LADWP's existing 287 kV Victorville-Mead line.	MountainPass2_sub	0
Build new 500 kV Barstow1 substation connecting 500 kV rebuild of 115 kV Coolwater-El Dorado line	Barstow1_sub	0
Build new 500 kV Barstow2 substation looping in existing 500 kV Adelanto-Marketplace #1 line	Barstow2_sub	0
Expand Lugo substation to terminate 500 kV Barstow1-Lugo #1, 500 kV Lucerne Valley-Lugo #1, 500 kV Kramer-Lugo #1, and 500 kV Lugo-Victorville #2 lines	Lugo_sub_expand	0
Connect Twentynine Palms CREZ to new Lucerne Valley substation with a trunk line.	0	0
Construct new 500 kV Pisgah substation looping in existing 500 kV Eldorado-Lugo and Mohave-Lugo lines	Pisgah_sub	0
Construct new 500 kV Lucerne Valley substation that connects the new 500 kV Pisgah-Lucerne Valley and new 500 kV Lucerne Valley-Lugo lines.	LucerneValley_sub	0
Expand Mira Loma substation to terminate 500 kV Pisgah-Mira Loma #1 line	MiraLoma_sub_expand	0
Construct new 230 kV Lone Pine substation with capability to expand to 500 kV	LonePine_sub	0
Upgrade Inyokern substation to 500 kV	Inyokern_sub_upgrade	0
Upgrade Kramer substation with 500 kV capability	Kramer_sub_upgrade	0
Expand Windhub substation to terminate 500 kV Kramer-Windhub #1 line	Windhub_sub_expand	0
Construct new 500/230 kV High Desert substation looping in existing 500 kV Victorville-McCullough #1 and #2 lines	HighDesert_sub	0
Expand Victorville substation to terminate 500 kV Lugo-Victorville #2 line	Victorville_sub_expand	0
Construct new 500/230 kV Fairmont substation looping in existing 500 kV Adelanto-Rinaldi #1 and Victorville-Rinaldi #1 lines	Fairmont_sub	0

New Substations and Network Upgrades	Upgrade Identification Name	Short Name
Construct new Eco 500/230/69 kV substation looping in existing 500 kV Imperial Valley-Miguel #1 line	Eco_sub	0
Expand Imperial Valley substation to terminate 500 kV Imperial Valley-Devers #1 line	ImperialValley_sub_expand	0
Implement Eco-Miguel generation SPS	Eco_Miguel_SPS	0
Construct new Solano 500/230 kV substation looping in existing 500 kV Vaca Dixon-Tesla #1 line	Solano_sub	0
Construct new West Gila substation looping in existing 500 kV North Gila-Imperial Valley #1 line	WestGila_sub	0
Expand Midway substation to terminate 500 kV Midway-Kramer #1 and #2 lines	Midway_sub_expand	0
Build 230 kV Carrizo switching station looping in existing Midway-Morro Bay 230 kV lines creating Morro Bay-Carrizo and Carrizo-Midway 230 kV lines	Carrizo_sub	0
Build new 500 kV bus at existing Gregg substation and add two 500/230 kV transformers	Gregg_sub_upgrade	0
Build a new 500 kV Northeast Oregon (NEO) substation including a +/- 500 kV AC-DC convertor with 3000 MVA thermal capability	NEO_sub_invertor	0
Build a new 500 kV Collinsville substation including a +/- 500 kV AC-DC convertor with 3000 MVA thermal capability.	Collinsville_sub_invertor	0
Add +/- 600 MVAR Static VAR Compensators (SVCs) at Selkirk, Devil's Gap, NEO Station, Collinsville, Tracy substation and near Cottonwood substation	PNW_SVCs	0
Possibly construct a third +/- 500 kV AC-DC convertor station with 1500 MVA thermal capability near Cottonwood substation	0	0
Install two 500/230 kV transformers at new Collinsville substation	Collinsville_sub_xfmrs	0
Install needed reactive power reinforcement at new Collinsville substation	Collinsville_sub_caps	0
Loop existing Tesla-Vaca Dixon 500 kV line into new Collinsville substation	Collinsville_sub_loopin	0
Construct new 500 kV Ravendale substation	Ravendale_sub	0
Construct new 500 kV Zeta 1 substation	Zeta1_sub	0
0	0	0
0	0	0
Construct new Mid-Point compensation station	Mid-Point_comp	0
Construct new 500 kV Dillard Road substation (SMUD interconnection)	DillardRoad_sub	0
Construct new 500 kV Tracy2 substation	Tracy2_sub	0
Construct new Alpha 4 substation with 500/230 kV transformation capability	Alpha4_sub	0
Construct new 230 kV Alpha 1 substation	Alpha1_sub	0
Break existing 230 kV New Melones #1 and #2 taps to the Wilson-Belotta 230 kV line and reconnect to the Alpha 4 substation creating 230 kV New Melones-Alpha 4 #1 and #2 lines	NewMelones_tap_reconfig	0
Construct new 230 kV Delta 1 substation	Delta1_sub	0
Construct Barren Ridge Switching Station looping in existing 230 kV Owens Gorge-Rinaldi line	BarrenRidge_sub	0

New Substations and Network Upgrades	Upgrade Identification Name	Short Name
Construct new Haskell Canyon switching station looping in upgraded 230 kV Owens Gorge-Rinaldi line and existing 230 kV Castaic Power Plant-Olive #1 line creating a 230 kV Castaic-Haskell Canyon #1 line and a 230 kV Haskell Canyon-Olive #1 line.	HaskellCanyon_sub	0
0	0	0
Construct DeversII 500/230 kV substation	DeversII_sub	0
0	0	0
0	0	0
0	0	0
Construct new Imperial ValleyII substation looping in existing El Centro-Imperial Valley 230 kV line and Dixieland-Imperial Valley 230 kV line	ImperialValleyII_sub	0
Add 230 kV transformation capability at Avenue 58 substation	Ave58_sub_upgrade	0
Add 230/287 kV transformation capability at Victorville substation (one transformer)	0	0
Add 230/230 kV phase shifting transformer at Victorville substation (one transformer)	0	0
Add 230/287 kV transformation capability at Victorville substation (two transformers)	0	0
Add 230/230 kV phase shifting transformer at Century (one transformer)	0	0
Construct new Eagle MountainII 500/230 kV substation	0	0
Add 500/230 kV transformation capability at Eagle MountainII substation (two transformers)	0	0
Add 230/230 kV phase shifting transformer at Eagle MountainII substation (one transformer)	0	0
Build new Camp Pendleton 500/230 kV substation looping-in reconductored 230 kV Talega-Escondido #1 line	0	0
Build new Lee Lake 500 kV switching station looping-in existing 500 kV Valley-Serrano #1 line	0	0
0	0	0
Tehachapi segments 4-11 BASED on SCE's PUBLIC WEBSITE DESCRIPTION	0	0
Construct Whirlwind 500/220 kV substation looping in existing 500 kV Midway-Vincent #3 line (creating 500 kV Midway-Whirlwind #1 line and Whirlwind-Vincent #1 line.) (segment 4)	Whirlwind_sub	0
Build new 220 kV Whirlwind-Cottonwood #1 line with double-circuit towers (4 miles) (segment 4) [This is a TRUNK LINE]	0	0
Build new 220 kV Whirlwind-Cottonwood #2 line on open side of towers (4 miles) (segment 4) [This is a TRUNK LINE]	0	0
Upgrade Windhub substation to 500 kV capability; initially operated at 220 kV (segment 9) [This is a COLLECTOR substation]	0	0
Add capacity banks at Windhub and Whirlwind 200/55 kV substation (segment 9) [These are COLLECTOR system upgrades]	0	0
Build new 500 kV Whirlwind-Windhub #1 line (15 miles) (segment 10) [This is a TRUNK LINE]	0	0

New Substations and Network Upgrades	Upgrade Identification Name	Short Name
Upgrade Antelope substation with switch rack, two transformers, new capacitor banks and a Static VAR Compensator (SVC) (segment 9)	Antelope_sub_upgrade	0
Upgrade Vincent substation by replacing existing transformer bank, expanding existing switch rack, adding two new capacitor banks and new circuit breakers. (segment 9)	Vincent_sub_upgrade	0
Build new 500 kV Duarte tap at southern edge of Angeles National Forest near city of Durarte in existing right-of-way. (segments 6 and 7)	Duarte_tap	0
Add 500/230 kV transformation capability at Rio Hondo substation	RioHondo_sub_upgrade	0
Add 500/230 kV transformation capability at Mesa substation	Mesa_sub_upgrade	0
Add 500/230 kV transformation capability at Gould substation	Gould_sub_upgrade	0
Add 500/230 kV transformation capability at Chino substation	Chino_sub_upgrade	0
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Appendix J. About Shift Factors

This section will be provided in the Phase 2A Final report.

Appendix K. Maps

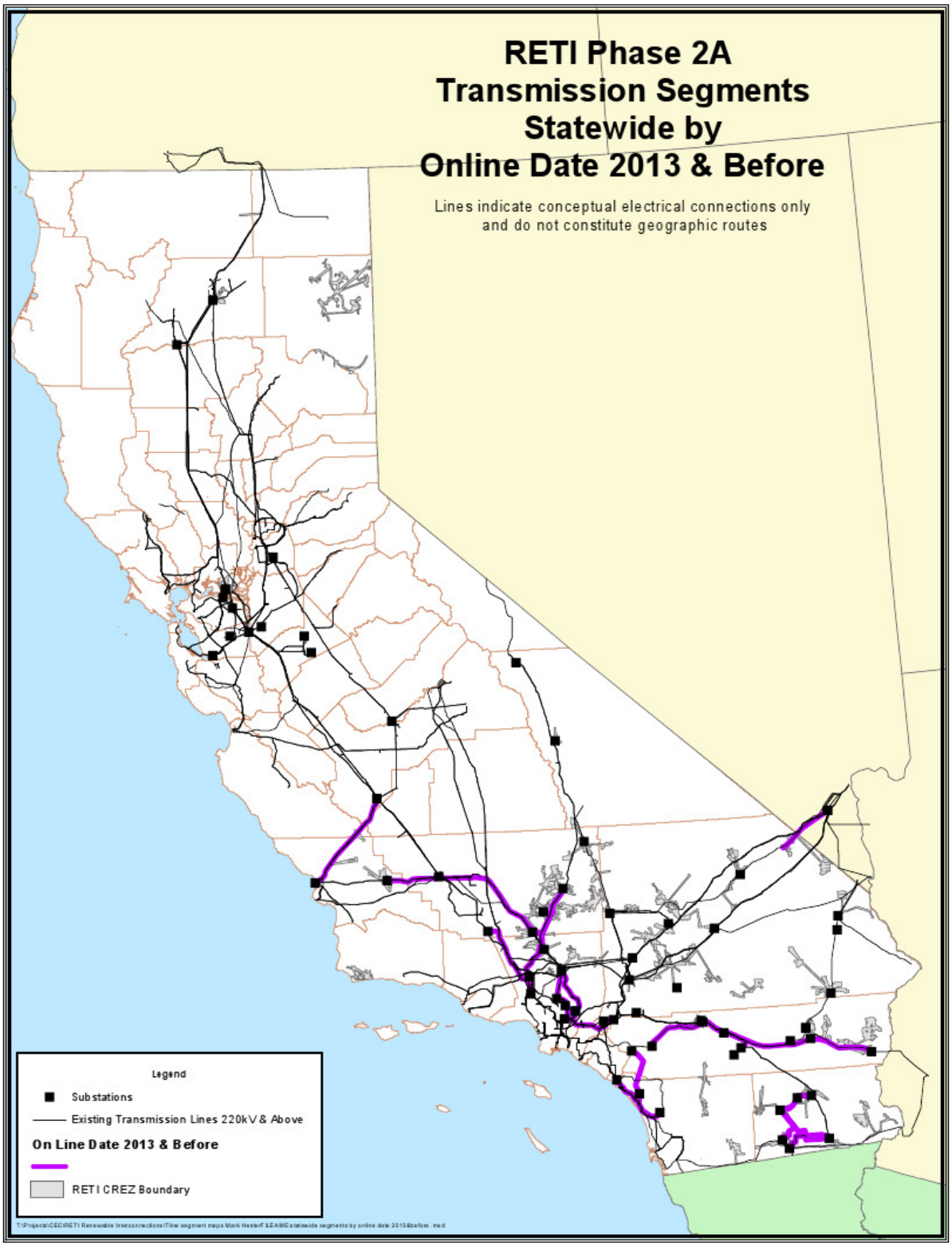

Figure K-1. Statewide segments by online date – 2013 and before.

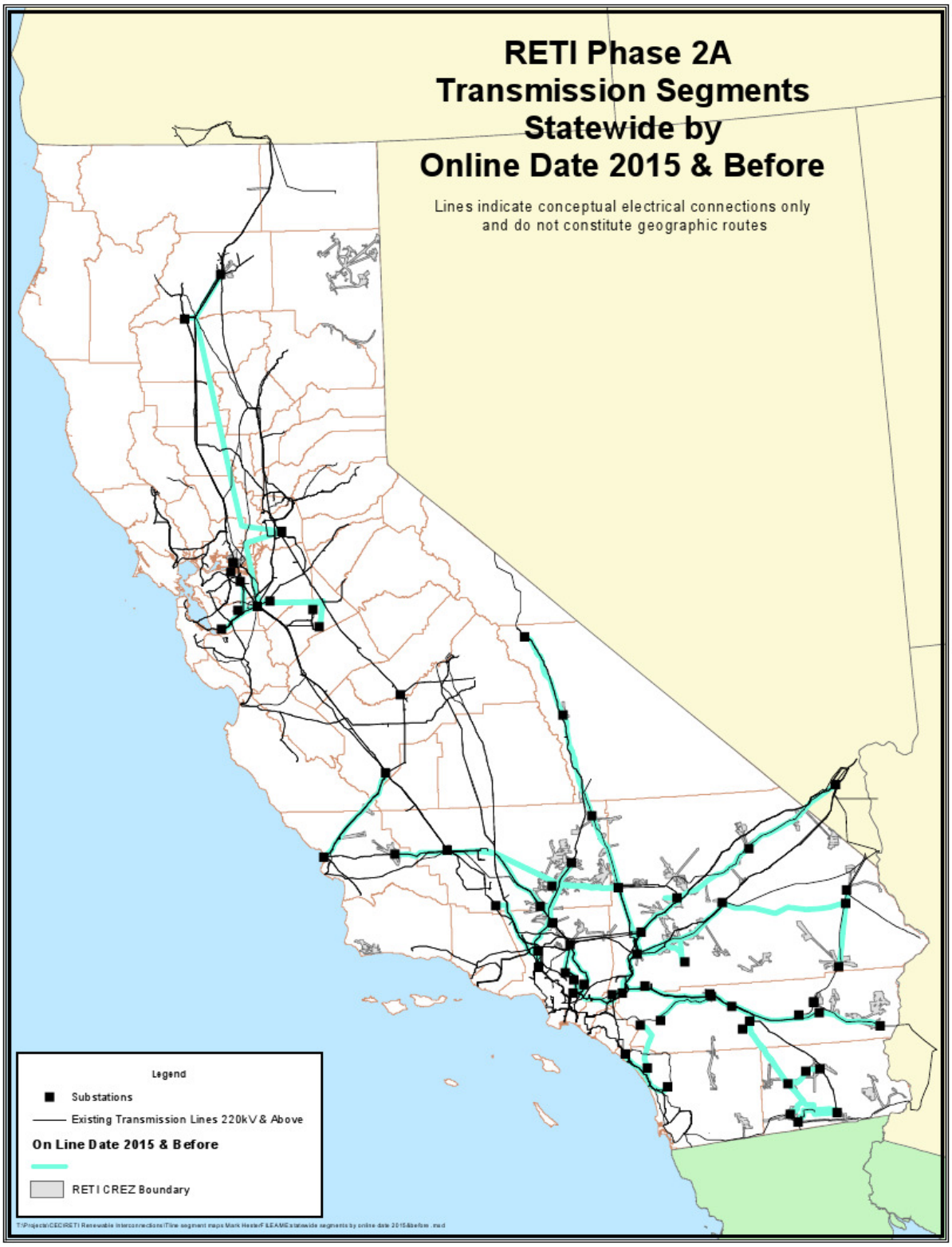

Figure K-2. Statewide segments by online date – 2015 and before.

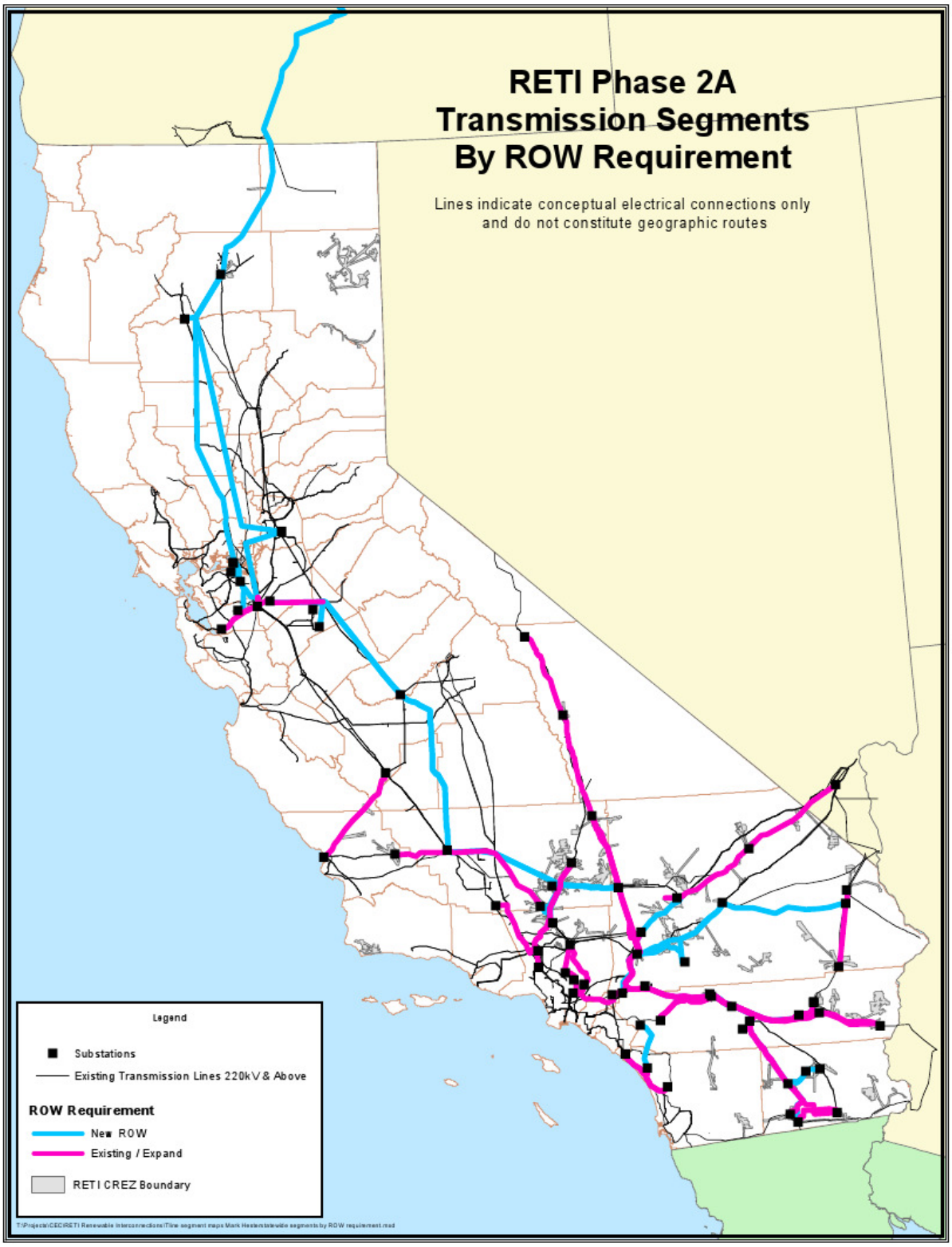

Figure K-3. Statewide Segments by ROW requirements.

Appendix L. Glossary

ACE	Area Control Error
ACEC	Area of Critical Environmental Concern
BLM	US Bureau of Land Management
CAISO	California Independent System Operator
CBD	Center for Biological Diversity
CEC	California Energy Commission
CEERT	Center for Energy Efficiency and Renewable Technologies
CEQA	California Environmental Quality Act
CFE	Comision Federal de Electricidad (Mexico)
COI	California-Oregon Interconnection
CPCN	Certificate of Public Convenience and Necessity
CPUC	California Public Utilities Commission
CPWG	RETI Conceptual Planning Work Group
CREZ	Competitive Renewable Energy Zone
CRWG	RETI CREZ Revision Work Group
Definitive Plan	A transmission line and facilities specified well enough that it could be approved by regulatory agencies for ratemaking and construction, versus a Conceptual Plan.
DFG	California Department of Fish and Game
DRECP	Desert Renewable Energy Conservation Plan
DWMA	Desert Wildlife Management Area
EIR	Environmental Impact Report
EWG	RETI Environmental Working Group
FERC	Federal Energy Regulatory Commission
FS	Facility Study
Gen-tie	Transmission line connecting a generator to the grid
GWh	Gigawatt-hour. 1 GWh = 1 thousand kWh
HCP	Habitat Conservation Plan
IID	Imperial Irrigation District
IOU	Investor Owned Utility
IVSG	Imperial Valley Study Group
kWh	Kilowatt-hour
LADWP	Los Angeles Department of Water and Power
LEAPS	Lake Elsinore Advanced Pumped Storage project
Looping	Connecting a new third point between two existing points already connected.
LSE	Load-Serving Entity
MW	Megawatt
MWD	Metropolitan Water District
NCCP	Natural Communities Conservation Plan
NCPA	Northern California Power Agency
NEPA	National Environmental Policy Act
NERC	North American Electric Reliability Council
NP15	North of Path 15

NRDC	Natural Resources Defense Council
PEA	Proponent's Environmental Assessment
PG&E	Pacific Gas & Electric Company
POU	Publicly-Owned Utility
PPA	Power Purchase Agreement
RAS	Remedial Action Scheme
RETI	California Renewable Energy Transmission Initiative
RMR	Reliability Must Run
ROW	Right Of Way
SCE	Southern California Edison Company
SCPPA	Southern California Public Power Authority
SDG&E	San Diego Gas & Electric Company
Sec 399.25	Section of California Public Utilities Code
SIS	System Impact Study
SMUD	Sacramento Municipal Utility District
SPS	Special Protection System
SSC	RETI Stakeholder Steering Committee
TANC	Transmission Agency of Northern California
TCSG	Tehachapi Collaborative Study Group
TRTP	Tehachapi Renewable Transmission Project
USFS	US Forest Service
USFWS	US Fish and Wildlife Service
WECC	Western Electricity Coordinating Council